Memoirs of the Museum of Comparative Zoology

AT HARVARD COLLEGE.

Vol. XXX. No. 1.

REPORTS ON AN EXPLORATION OFF THE WEST COASTS OF MEXICO, CENTRAL AND SOUTH AMERICA, AND OFF THE GALAPAGOS ISLANDS, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," DURING 1891, LIEUT. COMMANDER Z. L. TANNER, U. S. N., COMMANDING.

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THE SPONGES.

By H. V. WILSON.

WITH TWENTY-SIX PLATES.

[Published by Permission of Marshall McDonald and George M. Bowers, U. S. Commissioners of Fish and Fisheries.]

CAMBRIDGE, U. S. A.:

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THE SPONGES.

INTRODUCTION.

The collection of sponges with which the following report deals has been found to include forty-seven species and subspecies. Of these, twenty-six, representing thirteen genera, fall in the Hexactinellida, seven, representing three genera, fall in the Tetractinellida, and fourteen, representing nine genera, fall in the Monaxonida. No calcareous or horny sponges and no Lithistids were taken. As was to have been expected, since the expedition was made in unexplored waters, a very large percentage of the forms (thirty-three species and subspecies) prove new to science.

ENUMERATION OF THE SPECIES ACCORDING TO THE STATIONS AT WHICH THEY WERE TAKEN.

Serial Number.	Latitude.	Longitude West.	Depth in Fathoms.	Character of Bottom.	Species taken.
	° ′ ″	° ′ ″			
3354	N. 7 9 45	80 50 0	322	gn. M.	*Chonelasma calyx* F. E. Sch. (sp ?).
3358	N. 6 30 0	81 44 0	555	gn. S.	*Eurete erectum tubuliferum*, subsp. nov. *Eurete erectum mucronatum*, subsp. nov.
3359	N. 6 22 20	81 52 0	465	Rky.	*Eurete erectum tubuliferum*, subsp. nov. *Eurete erectum mucronatum*, subsp. nov. *Hexactinella ventilabrum* Carter (sp ?).
3362	N. 5 56 0	85 10 30	1175	gn. M. S. rky.	*Thenea fenestrata* O. Schm.
3363	N. 5 43 0	85 50 0	978	wh. glob. Oz.	*Hyalonema pateriferum*, sp. nov.
3368	N. 5 32 45	86 54 30	66	Rky.	*Phakellia lamelligera*, sp. nov.
3370	N. 5 36 40	86 56 50	134	Rks. and S.	*Staurocalyptus*, sp. *Eurete erectum* F. E. Sch. (sp ?) *Eurete*, sp. *Aphrocallistes vastus* F. E. Sch. (sp ?).
3376	N. 3 9 0	82 8 0	1132	gy. glob. Oz.	*Hyalonema pateriferum*, sp. nov.
3380	N. 4 3 0	81 31 0	899	Rks.	*Regadrella*, sp. *Hexactinella tubulosa* F. E. Sch. (sp ?) *Eurete erectum gracile*, subsp. nov. *Eurete*, sp. *Bathyxiphus*, sp.
3381	N. 4 56 0	80 52 30	1772	gn. M.	*Hyalonema*, sp.
3382	N. 6 21 0	80 41 0	1793	gn. M.	*Hyalonema ovuliferum* F. E. Sch. *Caulophacus schulzei*, sp. nov. *Bathydorus levis spinosus*, subsp. nov.
3384	N. 7 31 30	79 14 0	458	gn. S.	*Iophon chelifer ostia-magna*, subsp. nov.
3399	N. 1 ·7 0	81 4 0	1740	gn. Oz.	*Hyalonema*, sp. *Caulophacus schulzei*, sp. nov. *Bathydorus levis spinosus*, subsp. nov.

Serial Number.	Latitude.	Longitude. West.	Depth in Fathoms.	Character of Bottom.	Species taken.
	° ′ ″	° ′ ″			
3400	S. 0 36 0	86 46 0	1322	lt. gy. glob. Oz.	*Thenea fenestrata* O. Schm.
3404	S. 1 3 0	89 28 0	385	R.	*Euplectella*, sp. *Regadrella delicata*, sp. nov. *Hexactinella ventilabrum* Carter (sp ?). *Poecillastra tricornis*, sp. nov. *Penares foliaformis*, sp. nov. *Oceanapia bacillifera*, sp. nov.
3405	S. 0 57 0	89 38 0	53	P. Co. Sh.	*Hexactinella labyrinthica*, sp. nov. *Poecillastra cribraria*, sp. nov. *Polymastia maeandria*, sp. nov. *Petrosia variabilis crassa*, subsp. nov. *Petrosia similis densissima*, subsp. nov. *Tylodesma vestibularis*, sp. nov. *Iophon lamella*, sp. nov. *Iophon lamella indivisus*, subsp. nov. *Iophon indentatus*, sp. nov. *Auletta dendrophora*, sp. nov. *Tylodesma alba*, sp. nov.
3406	S. 0 16 0	90 21 30	551	R.	*Hexactinella tubulosa* F. E. Sch. (sp ?) *Hexactinella ventilabrum* Carter (sp ?) *Sclerothamnopsis compressa*, gen. et sp. nov.
3413	N. 2 34 0	92 6 0	1360	glob. Oz. dk. Sp.	*Thenea fenestrata* O. Schm.
3414	N. 10 14 0	96 28 0	2232	gn. M.	*Hyalonema pedunculatum*, sp. nov. *Hyalonema*, sp. *Caulophacus*, sp. *Thenea lamelliformis*, sp. nov. *Thenea pyriformis*, n. sp.
3415	N. 14 46 0	98 40 0	1879	br. M. glob. Oz.	*Hyalonema bianchoratum*, sp. nov. *Thenea echinata*, sp. nov.
3425	N. 21 19 0	106 24 0	680	gn. M. and S.	*Farrea occa claviformis*, subsp. nov. *Farrea*, sp.
3430	N. 23 16 0	107 31 0	852	bk. S.	*Farrea mexicana*, sp. nov.
Station recorded as "Acapulco."					*Pachychalina acapulcensis*, sp. nov.
Station recorded as "Panama."					*Gellius perforatus*, sp. nov.
17 (Cruise of "Albatross" in 1900.)	N. 0 50 0	137 54 0	2463	lt. y. gy. glob. ooze	*Hyalonema pateriferum*, sp. nov.

In addition to the discovery of new forms, some results of general biological interest have accrued from the study of the collection, and are discussed or stated under the respective species concerned. For convenience of reference the more important of these facts may be here classified.

Remarkable forms. *Hyalonema pedunculatum*, p. 15, is noteworthy for the peculiar pedunculate form of body; *Sclerothamnopsis compressa*, p. 80, for the shrub-like habitus in which it resembles the hitherto unique *Sclerothamnus clausii* Marsh.; *Regadrella delicata*, p. 32, for the character of the sieve-plate region, which may be construed as representing a simpler (although not necessarily a more primitive) phylogenetic condition than the otherwise closely similar *Regadrella phoenix* O. Schm.

Distribution and *Habitat.* *Thenea fenestrata* O. Schm., p. 87, hitherto known only from the Atlantic and Caribbean Sea, is now recorded for the

Pacific. Some of the Hexactinellids from great depths have been found to live clustering upon one another: *Caulophacus*, pp. 39, 46, attached to root spicules of *Hyalonema; Bathydorus*, p. 47, attached to root spicules of *Hyalonema* and to stalks of *Caulophacus* or similar sponge.

Morphology in general. Further evidence of a convincing character has been gained that the complex *Eurete* and *Farrea* colonies are derived ontogenetically from simple cup-like forms, pp. 60, 61, 66.——The close similarity between the main afferent and efferent canals and their apertures in *Poecillastra tricornis* is worthy of remark, p. 97.——The observations of Sollas and of Dendy on the occurrence of a peculiar fenestrated membrane (Sollas's membrane) in the flagellated chambers of certain sponges have been confirmed for two Tetractinellid genera, *Poecillastra* and *Penares*, pp. 99, 103, 109.

Pathological phenomena in general. In *Euplectella* skeletal septa of a reticular character have been found crossing the cavity of the sponge, p. 29.——In *Chonelasma* similar septa have been observed, p. 70.——In *Hexactinella labyrinthica* skeletal masses of a reticular character, such as have been especially described by Weltner, occur, p. 75. In some cases such masses form layers separating one part of the sponge from another.——Possibly all these phenomena are pathological and similar, in so far as they may indicate an effort of the sponge to shut off one part (diseased?) of the body from the rest.

Morphology of spicules — variations and "*pathological*" *conditions.* In *Hyalonema pateriferum*, pathological amphidiscs such as have been observed by Marshall and Meyer and F. E. Schulze occur. In these spicules, p. 28, several additional rays of the hexact are developed.——Certain details in the structure of the discohexasters of *Caulophacus schulzei* suggest that a hexaster may arise from a hexact through the development of *lateral* branches on the hexact rays, pp. 44, 45.——Another case is afforded by *Hexactinella labyrinthica* of what seems to be the degeneration of an uncinate into an oxydiact, p. 77.——In scopulae present in *Sclerothamnopsis compressa*, the arrangement of the axial canals indicates that the spicule is equivalent to a branched diact, as Schulze has supposed, p. 82.——Abundant transitional forms indicate that the protriaenes of *Thenea* are modified dichotriaenes, p. 85.——In *Thenea pyriformis* a type of metaster is common which may be interpreted as transitional between spirasters and euasters, p. 96.——In *Penares foliaformis* peculiar dichotriaenes are found which approach the shape of the Lithistid phyllotriaene,. p. 109.——The occurrence of pathological branching oxeas is recorded for *Petrosia*, p. 115.

Variation. The variability of sponges in regard to points of adult structure is universally recognized. O. Schmidt and Vosmaer, in particular, have laid stress on the phenomenon as bearing upon the problems of systematic classification. The observations recorded in this report will fall under the following heads:—

1. Variation in *body-shape* and *general anatomy.*

Attention may be called to the difference in shape exhibited by specimens of *Hyalonema pateriferum*, p. 24, *Caulophacus schulzei*, p. 39, *Thenea fenestrata*, p. 84, *Petrosia variabilis crassa*, p. 114.——In *Eurete* the spiral form of body beset with cup-like outgrowths varies toward a bilateral symmetry, p. 72.—— In *Tylodesma alba* massive and lamellate bodies occur, as parts of one continuous specimen, p. 132.——In *Gellius perforatus* a uniform habit of growth may result in very different body shapes, p. 128.——In *Thenea* individuals the number and size of the pore areas vary, pp. 84–85 (comp. especially Vosmaer, 1882, 1885); also the spicular fringe round the osculum, p. 84.——In *Iophon lamella* the character of the surface varies in different parts of the same individual, owing to the divergence in character of the main efferent canals and their apertures, and to the varying amount of collenchyma round such canals, pp. 142–144.

2. Variation in *same individual* in the *skeletal framework* or the *skeleton in general.*

In *Chonelasma calyx* the tuberculation of the beams of the dictyonal framework varies, p. 71.——In *Hexactinella ventilabrum* there is considerable variation in the way in which the hexacts combine to form the dictyonal framework, p. 79.——In *Thenea fenestrata* there is variation in the development of the spicular fringes round the pore areas, p. 85.——In *Petrosia variabilis crassa*, p. 116, and in *Petrosia similis densissima*, p. 118, a skeletal reticulum remains undeveloped in spots.——In *Pachychalina acapulcensis* the skeletal framework in places is fairly regular, although in general irregular, p. 122.——In *Phakellia lamelligera* the skeletal lamellae vary in respect to branching, p. 153.——In *Petrosia similis densissima* over some parts of the surface there are no projecting spicules, while over other parts such spicules are present in considerable number, p. 118.——In *Gellius perforatus* there is considerable variation in the character of the spicular tufts which project from the surface, p. 128.——In *Iophon lamella* there is variation in the number of spicules which combine to form the side of a skeletal mesh, p. 145.

3. Uncorrelated variation in the *megascleres* of an *individual, i. e.* variation apparently not correlated with the structural peculiarities of the body-locality.

As regards size of the spicules, there seems to be noticeable variation in all sponge species. —— The shape of one of the macramphidiscs varies considerably in *Hyalonema bianchoratum,* p. 20. —— In *Caulophacus schulzei* the principal hexacts are occasionally tuberculated, p. 40, and in the same species the tuberculation of the pentacts varies, p. 43. —— The character of the diact ends varies commonly, *e. g.* in *Bathydorus levis spinosus,* p. 49. —— In *Farrea mexicana* the pentacts vary in respect to tuberculation, p. 56. —— In *Eurete erectum* the character of the distal ray of the gastral pinules varies extensively, p. 62 (comp. F. E. Schulze, 1899). —— In *Petrosia variabilis crassa* the oxea sometimes assumes the shape of a strongyle, or style, p. 115. —— In *Penares foliaformis* the triaenes vary considerably, p. 109. —— In *Pachychalina acapulcensis* the size of the oxea varies within wide limits, p. 121. —— In *Phakellia lamelligera* the oxeas and the two kinds of styles all vary considerably in shape, p. 152.

4. Uncorrelated variation in the *microscleres* of an *individual.*

The microscleres as well as the megascleres very commonly vary in size and detailed shape, although in them, as in the megascleres, there is a size and pattern which are characteristic of the individual (species), *i. e.* to which the majority of the spicules of an individual conform.

Some striking cases of variation are afforded by the micro-oxyhexacts of *Hyalonema bianchoratum,* p. 19, plesiasters and spirasters of *Thenea fenestrata,* p. 86, sigmata of *Tylodesma alba,* p. 133.

5. Correlated variation in the *spicules.*

In some cases the variation of spicules is obviously not ungoverned by the rest of the body, but is correlated with body-locality.

Thus while the pentacts in *Hexactinella labyrinthica* vary at large in respect to length of the several rays, the pentacts overlying the larger inhalent canals commonly have noticeably short proximal rays. Such a phenomenon would customarily be referred to as "adaptive." —— The variation of dichotriaenes toward the protriaene type, round the pore areas of *Thenea,* pp. 85, 89, 92, 95, is another instance of the same phenomenon. —— A complex instance of correlated variation is afforded by the dermal and gastral pinules of *Caulophacus schulzei,* which coat the opposite surfaces (pore and oscular) of the body. The two kinds of pinules vary in the same direction in different individuals, and thus the proportionate difference between them is preserved, p. 42.

6. *Qualitative variation?*

Two sets of individuals living together in the same locality, and which are otherwise indistinguishable, differ conspicuously in respect to a single point. An instance is afforded by *Eurete erectum mucronatum,* which differs from *Eurete erectum tubuliferum* in having oxyhexasters instead of onychasters, p. 64. Another instance is afforded by *Iophon lamella indivisus,* which differs from *Iophon lamella* only in the character of the bipocillus, which is not chelate, p. 145.—— In order not to confuse the facts with hypothesis, the two sets of individuals have in each case been separated as subspecies. It is idle to dogmatize or to speculate *in extenso* on the value, from the standpoint of heredity, of the point of difference. Whether this point is inheritable and thus marks off two races, or whether it merely marks off two sets of individuals which started out alike and the offspring of which are alike, and which owe their difference to the action on the individual of the environment, no one can say. The recording of the difference is the duty of the systematist, who, when he has done so, has pointed out an additional case suitable for the experimental study of heredity and environmental action.

7. *Variation towards other species or subspecies.*

A class of spicules in one subspecies may vary in considerable number towards a condition characteristic of a subspecies inhabiting a different locality. An instance is afforded by *Eurete erectum gracile,* in which the tuberculation of the gastral pentacts and hexacts is sometimes very similar to that found in the other subspecies of *Eurete erectum,* p. 66.

Or a form of spicule characteristic of one species may occur infrequently in a related species. For instance, in *Caulophacus schulzei* the pinuli occasionally have the shape characteristic of *C. latus* and *C. elegans,* p. 42. A striking case is afforded by *Farrea occa claviformis,* in which a few gastral clavulae were found closely similar to the peculiar clavulae of *Farrea convolvulus,* p. 55.

8. *Constancy* of *character in spicules.*

It often happens that while in a single individual the *size* of a particular spicule may vary within wide limits, the *character* remains fairly constant, *e. g.* pinuli of *Hyalonema bianchoratum*, p. 20.——The character of a spicule even in minute details may apparently become fixed for the species. Thus in a specimen of *Hyalonema ovuliferum* the rays of the micro-oxyhexacts have the same sudden terminal curving exhibited by the corresponding spicules of Schulze's type specimen, although the two sponges were taken 49° of latitude apart, pp. 13, 15.——A form of spicule which in some sponges varies greatly in size, in other species varies but little. Thus in *Gellius perforatus* the sigmata vary only slightly, p. 129, whereas in *Tylodesma alba* they vary greatly, p. 133.

I do not undertake a comparative consideration of the geographical distribution of the forms making up the collection. Such a consideration would demand a knowledge of the actual systematic value to be attached to many *species* recorded in the literature of sponges. And such knowledge is not to be had at present. In modern sponge literature, *e. g.* in the two great monographs of Schulze and Sollas (Schulze, 1887; Sollas, 1888), the species conceived are, as it seems to me, what H. M. Bernard contends for in his interesting recent discussions (Proc. Cambridge Phil. Soc. Vol. XI. Pt. IV.; Verhdlg. V. Intern. Zool.-Congress) of the species-question as affecting the method of recording certain data, *viz.* homogeneous morphological groups. The sponge species are often very homogeneous, because represented by single specimens. That such groups answer always to natural species, as we understand the word when we speak of the human race, *Passer domesticus*, *Littorina litorea*, or other organisms which we know in great number, is not only open to doubt, but is excessively improbable. It is, I suppose, from this latter point of view (the envisaging clearly the *a priori* probability that sponges in general exhibit those individual and local differences which all species known intimately exhibit) that O. Schmidt was led to record in literature the existence of such species as *Farrea facunda*. Perhaps *Farrea facunda* is a "natural species," but the data at hand make such a statement only a subjective assumption. Or when the distinguished systematist Topsent expresses the opinion (1902, p. 12) that five species of *Poecillastra* recorded by Sollas probably represent the variations of two or three species, one is justified in saying "perhaps, but the known specimens differ in certain definite respects." Such subjective interpretations of differences perhaps always affect the manner in which we record the occurrence of certain morphological peculiarities in association with geographical and bathymetrical site. But whereas once they were rampant, to-day they are reduced to a minimum, with the result, as I have said, that the *species* of modern sponge literature are strikingly homogeneous groups, which need not be thought of as always corresponding to natural races.

That this method of precise analysis is the only method capable of yielding trustworthy data, seems to me incontestable. That it may result in temporarily recording more species than exist in nature, will only trouble those who incline to the view that the one excuse for systematic zoölogy is to provide them with a handy collection of names for the animal kingdom.

The data which are thus accumulating as to the occurrence of this or that peculiarity of structure in a certain locality are growing rapidly through the labors of systematists. Scarcely begun is the accumulation of the almost equally important data (comp. Polćjaeff, Report on the "Challenger Keratosa," p. 85), as to what peculiarities of structure are due to a difference in the physiological state of individuals belonging to the same race. Such knowledge, to be acquired through continuous observation of living individual sponges under normal and under modified conditions (experimental method) may be expected to bring about the union of many recorded *species.*——Another most important class of data can only be revealed through the physiological study of the *race, viz.* through the breeding of sponges. And with the increase in the number of marine laboratories at which observations may be carried on continuously throughout the year, the inauguration of such studies may be anticipated.——The modern statistical method of considering the differences between individuals of such groups as are procurable in large numbers is a refinement of what is commonly understood as systematic work, and a promising field for those acquainted with the structure of sponges. Such studies, by revealing the kinds and the extent of structural modifications which occur among individuals not separable into morphologically definable groups, may be expected to provide invaluable special cases for experimental study.——It is through the combination of these several classes of data that we must hope to learn the limits of the natural groups of sponges as they exist to-day. When such trustworthy definitions of natural groups are at hand, the facts of the geographical distribution of the species will doubtless become intelligible.

In the classification of the Hexactinellida the changes introduced by Schulze and Ijima in the system of the former, as laid down in the "Challenger" Report on the Hexactinellida, have been in general adopted, where they concerned the types treated of in this Report. For the Tetractinellida I make use of Sollas's system. Topsent in a recent discussion (1902) proposes certain changes in Sollas's treatment of the streptastrose forms, but the changes proposed especially concern the *definition* of the genera and the two subdivisions, and do not materially alter the classification of the group. Lendenfeld's very extensive changes in the classification of the *Astrophora* (1894, 1903) do not seem to me an improvement on the system of Sollas. In dealing with the Monaxonida I employ Topsent's group *Hadromerina* (1898) and also follow this author (1894 *a*) in the division of the *Halichondrina* into families.

In regard to spicule terminology the usage except in minor particulars and with respect to a few terms has been practically uniform since the "Challenger" Reports. The useful list of Schulze and Lendenfeld (1889) includes terms employed in the "Challenger" Reports and others as well. Some of the latter offer no advantage over the "Challenger" terms, and have not been generally adopted, *e.g. amphiox* for *oxea, amphistrongyl* for *strongyle, amphityl* for *tylote, chelotrop* for *calthrops.* Vosmaer (1902) in a recent paper full of interest discusses some of the forms with regard to which there is not a uniform usage. Prominent among these is the *streptaster.* Sollas (1888) included under this head a long series of forms, which he divided into *plesiasters, metasters, spirasters, amphiasters,* and *sanidasters.* Of these the first four, and especially the first three, intergrade freely. Vosmaer thinks it impossible to carry out in practice the distinction between *plesiasters, metasters,* and *spirasters,* and would designate them all *spinispirae,* including under this term some at any rate of Sollas's *amphiasters.* Schulze and Lendenfeld (1889) use *spiraster, amphiaster,* and *sanidaster* in the sense of Sollas, and do not use *plesiaster* and *metaster,* but employ the term *streptaster* for spicules which in Sollas's terminology would fall under these two heads. Lendenfeld (1903, p. 12) continues to use the terms *amphiaster* and *spiraster,* but does not employ *streptaster, metaster, plesiaster,* nor *sanidaster.* The *sanidasters* (Sollas) are included under *microrhabds* (Lendenfeld), *e.g.* in *Tribrachion schmidtii* Weltn. The *spirasters* and *metasters* of Sollas are together included in *spirasters* (Lendenf.), *e.g.* in *Pachastrella* (*Poecillastra*) *schulzei* (Soll.) The *plesiasters* (Sollas) are passed over to the *oxyasters* of Lendenfeld, *e.g.* in *Ancorina* (*Thenea*) *fenestrata* (O. Schm.). Thus Vosmaer and Lendenfeld do not agree, and they both differ from Sollas.

In this matter Topsent (1902) adheres to the terminology of Sollas, and I likewise employ it. That the types singled out from the streptaster series by Sollas exist is of course indisputable. That they also intergrade, cannot be questioned. And this latter fact makes it necessary, whatever technical terms be employed, to *describe* the spicules of each species. Nevertheless Sollas's subdivision of the *streptasters* and his technical terms greatly facilitate reference to the spicules, and also make for accuracy of description. By combining the terms the transitions between the types may in a measure be indicated, *e.g.* in *Poecillastra cribraria* the microscleres of the dermal membrane (Plate **14**, Fig. 12 *a*) are typical *spirasters*, while those of the parenchyma are *plesiasters* (Plate **14**, Fig. 12 *b*) or *plesiaster-metasters* (Plate **14**, Fig. 12 *c*, 12 *d*) and more rarely typical *metasters*.

The lists of generic synonymy that are given include references to memoirs in which the genus as a whole is defined or in some way discussed, but are by no means complete guides to the species of the several genera.

In stating the size of tapering spicule rays, the thickness given is the greatest thickness, unless mention is made to the contrary.

In the case of some macerated skeletons of Hexactinellids only a direct comparison with types or with determinable specimens could give any warranty for an identification. And even then a doubt, expressed by a query, remains as to the species, although the direct comparison enables one to say that forms agreeing in dictyonal framework with certain described species occur in such a region.

After having made provisional identifications of the forms included in the collection, I found that before the work could be completed, it would be necessary to examine certain types deposited in European museums. The trustees of the University very kindly granted me leave of absence for the year 1902–03, for which I offer to them and to President Venable my sincere thanks. To the trustees and to President Gilman of the Carnegie Institution I wish also to express my hearty thanks for a generous grant which enabled me to carry out my plans. My year was spent chiefly in Berlin, in the laboratory of Geheimrath F. E. Schulze, although visits were made to the museums in London, Paris, and Leyden. To Geheimrath Schulze I am under lasting obligation, not only for the permission to occupy a working place in his Institut, but for the generosity with which he allowed me to make use of his library, photographic atelier, and collections, in particular his magnificent collection of microscopical preparations of the Hexactinellida, and finally for the helpful suggestions and friendly aid with which he responded to all of my calls for assistance. To another friend in Berlin, Professor Wilhelm Weltner, Custos in the Museum für Naturkunde, I am likewise under deep obligations for assistance in the use of the admirable collections of the Museum, and for aid of many kinds. To Geheimrath K. Möbius, Direktor of the Museum für Naturkunde, I offer my respectful thanks for the use of the photographic atelier, and for the kindly permission to make free use of the library and collections in the Museum. My respectful thanks are also due to Geheimrath E. von Martens of the Museum für Naturkunde for facilities allowed me during the course of my work in the Museum.

To the following gentlemen also I beg leave to express my thanks: to Professor E. Ray Lankester, Director of the British Museum (Natural History), for permission to examine types, and to Professor T. Jeffrey Bell and especially to the curator of sponges, Mr. R. Kirkpatrick, of the same Museum, for courtesies shown me during my visit; to Professor Edmond Perrier, Director of the Muséum d'Histoire Naturelle, for permission to examine the collections, and to Professor E. L. Bouvier of the Muséum for courtesies shown me during my visit; to Professor E. A. Jentink, Director of the Rijks Museum in Leyden, for permission to examine types, and to Dr. R. Horst of the same Museum for courtesies shown me during my visit.

Finally I desire to thank Mr. Agassiz not only for the opportunity of studying the valuable collection upon which I now report, but for the patience with which he has waited for the report.

University of North Carolina,
Chapel Hill, N. C.
Jan. 22, 1901.

SYSTEMATIC ACCOUNT OF THE GENERA AND SPECIES.

HEXACTINELLIDA O. Schmidt.

AMPHIDISCOPHORA F. E. Schulze.

HYALONEMATIDAE Gray.

Hyalonema Gray.

1832. *Hyalonema* Gray, 1832, p. 79.
1887. *Hyalonema* Gray, Schulze, 1887, p. 189.
1893. " " " 1893 a, p. 28.
1894. " " " 1894, p. 18.

Hyalonema ovuliferum F. E. Schulze.

1899. *Hyalonema ovuliferum* F. E. Schulze, 1899, p. 13, Taf. ii. Figs. 9–12.

Station 3382. One fragmentary specimen, comprising the lower end of what must have been a larger sponge than Schulze's type.

The fragment is a solid, elongated, and bilaterally compressed mass, through the middle of which the root spicules pass as a compact bundle. The root spicules are broken off 10 mm. below the rounded lower end of the sponge, and do not quite project from the upper end. Over the upper end of the fragment the dermalia and hypodermalia and the peripheral layer of parenchymal hexacts are absent, and this end doubtless represents the place at which the upper part of the body was broken away. The sponge is compact, although soft and easily torn. The surface, which is much injured, shows the apertures of numerous small canals not exceeding 1 mm. in diameter. The piece is 50 mm. long, with transverse diameters of 25 and 15 mm. respectively.

At the extreme lower end the sponge tissue round the emerging root tuft is not differentiated to form a hard and dense mass (basal collar-pad), although the principalia here exhibit the usual modification. The free portion of the root tuft is 3 mm. in diameter, and includes about 12 spicules, which are in the neighborhood of 400 μ thick, none exceeding 450 μ in thickness.

In the smooth principal oxyhexacts the rays are 250 to 850 μ long, with a basal thickness of 12 to 40 μ. In the peripheral region of the parenchyma these spicules are abundant, and for the most part regularly disposed, so as to produce roughly cubical meshes. In the deeper part of the parenchyma the hexacts are rare, and are arranged without regularity.

The smooth oxydiacts measure 750 to 1700 μ in length, with a thickness of 8 to 20 μ near the median enlargement. They are comparatively scarce in the dermal membrane and peripheral parenchyma, but very abundant in the deeper parenchyma, where they run in all directions, often arranged more or less distinctly in bundles.

In the smooth, hypodermal oxypentacts there is no trace of the distal ray. The tangential rays vary from a length of 200 μ, with a basal thickness of 16 μ, to a length of 1000 μ, with a basal thickness of 80 μ. The proximal ray is commonly half again, or twice as long as the tangential rays. The spicules are very abundant, and almost alone are concerned in forming the hypodermal meshwork, hypodermal diacts being rare.

The smooth micro-oxyhexacts are very abundant throughout the parenchyma. The rays are 24 to 30 μ long, slender and straight nearly to the end, where they are rather suddenly and distinctly curved.

The dermal pinules are very long and slender. The tangential rays are nearly cylindrical and then rather suddenly pointed, beset with scattered sharp microtubercles. On the distal ray the teeth are sharp and short, not exceeding 10 μ in length (measured along upper border of tooth), becoming gradually reduced in size toward the upper and lower ends of the ray. The upper end of the distal ray in the spicules scattered over the general surface is broken off, but the ray becomes very slender above, and the shape indicates that it terminates in a long point. In the common sizes of this spicule the tangential ray measures 60 to 90 μ long by 12 μ thick; the distal ray, 750 to 900 μ long, thickness of the lower smooth part of ray, 16 μ. At the extreme lower end of the specimen the pinules have distal rays only about $\frac{1}{3}$ as long as elsewhere. In Schulze's type specimen the dermal pinules had a distal ray 300 to 400 μ long. As regards this point, therefore, my specimen differs from the type, but the difference cannot be regarded as of importance, since the *character* of the pinule is the same in both sponges.

The larger variety of macramphidisc has a total length of 200 to 320 μ. The length of the bell-shaped umbel is slightly less than $\frac{1}{3}$ the total length of the spicule, and $1\frac{5}{10}$ times the width of the umbel. The shaft bears at its middle a circle of small protuberances, and usually other protuberances are scattered irregularly along it. In some cases there are three circles of protuberances, one in the middle, and one toward each end of the shaft. The shaft is very slender, excluding tuberosities about 5 μ thick. The spicule is abundant in the dermal membrane, and is present also in the parenchyma, particularly in the peripheral region.

The ellipsoidal form of macramphidisc has a total length of 60 to 80 μ. The greatest width of the umbel is about equal to its length, and the umbels nearly meet at the equator of the spicule. The arrangement of the protuberances on the shaft varies. More commonly they are aggregated into one group at the middle. Frequently, however, there may be two such groups, on opposite sides of the middle point of the shaft. In some spicules the protuberances extend nearly over the entire length of the shaft. The spicule is abundant in the dermal membrane, and also present in the parenchyma.

Small amphidiscs, which collectively may be referred to as micramphidiscs, are abundant in the parenchyma. How abundant they are in the dermal membrane is impossible to determine, since the surface is injured. The smallest of these spicules are micramphidiscs of the common type, with umbels about $\frac{1}{3}$ the total length of the spicule, or somewhat less. The total length of the spicule is 16 to 24 μ. The umbels are as wide as deep, and with numerous (about 16) teeth. The shaft is generally smooth and enlarged in the middle; in some of the larger spicules spinose in the middle. —— Other small amphidiscs in which the umbels closely approach or reach the equator of the spicule, and in which the shaft is spinose, form a series leading up from a length of 30 μ to the ellipsoidal form of macramphidisc 60–80 μ long. As an example may be given a spicule measuring 30 μ long by 18 μ wide, in which the teeth of the opposite umbels meet at the equator. —— Still another type of small amphidisc 30 to 50 μ long, resembling in general the elongated form of macramphidisc, is abundant in the parenchyma. The shaft bears sharp tuberosities, and the umbels are bell-shaped, somewhat deeper than wide, and something more than $\frac{1}{3}$ the total length. Very rarely a spicule is found intermediate in size and character between these and the smallest indubitable specimens of the elongated macramphidisc, which measure about 110 μ in length, and themselves are not common.——In the small amphidiscs, up to lengths of 50 μ, it is only possible to count the umbel rays with accuracy, in apical or approximately apical view. In such view it may often be seen that the number of rays is more than 8, being in the neighborhood of 14.

At the extreme lower end of the specimen acanthophorae are found in considerable abundance. They include diactines, tauactines, and stauractines, in which the ends are spinose, and commonly rounded and enlarged, although sometimes pointed. In the tauactines and stauractines the rays are subequal or very unequal, 12 to 16 μ thick, and commonly less — often much less — than 200 μ in length.

I have examined preparations of Schulze's type, and find that the only tangible point of difference between the two sponges is the difference in the length of the distal rays of the dermal pinules. On the other hand, the dermal pinules, the two forms of macramphidisc, and the micro-oxyhexacts, have in the two sponges the same *character*, even as to many minute details of structure, such as the sudden curving exhibited by the rays of the micro-oxyhexact.

The type specimen was taken to the west of Prince of Wales Island (55° 20′ N., 136° 20′ W.), at a depth of 2869 metres on a muddy bottom.

Hyalonema pedunculatum, sp. nov.

Plate 3, Figs. 1-6.

Diagnosis. Body pipe-shaped, produced below into a peduncle bent upon the body. Gastral surface deeply concave. Canals very small, and consistency dense. Dermal and gastral pinules with bushy distal ray, 320–440 μ long, ending above in a cone. Micro-oxyhexacts with straight or slightly curved, minutely denticulate rays, 50–60 μ long. Macramphidiscs of one kind, 120–180 μ long, with wide umbels, which nearly reach the equator of the spicule.

Station 3414, one specimen.

The lower part of the sponge (Plate **3**, Fig. 5) forms a peduncle-like process, strongly bent upon the morphological vertical axis of the body. The peduncle was broken across at a short distance from the body, the actual lower end of the sponge not being present. The upper or gastral surface exhibits a deep, narrow concavity, shown in sectional view in the figure, which represents the sponge after a part of the lateral surface has been sliced off. A ridge such as usually marks the passage of the upper or gastral into the lateral or dermal surface is distinguishable only on one side of the body, and does not contain peculiar marginal diacts. The gastral surface to one side of the deep cavity exhibits a sharp protuberance, which superficially suggests the central conus found in some species of Hyalonema. At another point (in the left of the figure) the periphery of the body, where gastral and dermal surfaces meet, is produced into an ear-like lobe overarching a lateral concavity. The expanded part of the body has a greatest horizontal diameter of 24 mm., and a similar depth. The peduncle, which is flattened, is 10 mm. thick in one transverse axis and 5 mm. thick in the other.

At one side of the stalk-like process, just beneath the surface, traces of the bundle of root spicules remain. Three of the spicules are still in place. These are broken across at their lower end, but may be followed upward in the sponge as far as the union of the peduncle with the expanded part of the body. In addition, seven cavities remain, from which root spicules have been pulled out. These cavities are mostly 350 to 400 μ in diameter, while the actually remaining spicules range in diameter from 75 to 200 μ.

The entire body is very dense and firm, the canals being 0.5 mm. and less in diameter. These small canals open in some abundance on both dermal and gastral surfaces. The dermal and gastral membranes are not reticulate, but exhibit where uninjured a thick furze of projecting pinuli, which is discernible to the eye.

The parenchymal macroscleres are smooth oxyhexacts and smooth oxydiacts. In the oxyhexacts the rays are subequal and tapering. In the commoner sizes the ray measures 420 x 24 μ to 1 mm. x 70 μ. The spicule is only fairly abundant.——The oxydiacts are exceedingly abundant, scattered in all directions in the upper body, arranged predominantly lengthwise in the stalk. There is commonly an enlargement, often very slight, at or near the middle, and the rays taper evenly. The spicule measures 1–2 mm. in length, 12–20 μ in thickness.

The hypodermalia and hypogastralia are abundant and alike. They are smooth oxypentacts with no remnant of the distal ray, the other rays tapering evenly. The size varies considerably. In a common size the tangential ray measures 370 μ x 36 μ, the proximal ray 670 μ x 40 μ, but much smaller spicules are abundant.

The micro-oxyhexacts are extremely abundant throughout the parenchyma. The rays are straight (Plate 3, Fig. 3) or slightly curved (Plate 3, Fig. 1), taper gradually to a fine point, and are beset with very minute sharp prickles. The ray is 50–60 μ long, and 4 μ thick at the base. Both the straight and curved varieties are common, although the form with straight rays predominates.

The dermal and gastral pinuli are alike. They are large, strong pentact pinuli (Plate 3, Fig. 4), with no trace of the proximal ray. The distal ray is 320–440 μ long, with a greatest diameter of 30–60 μ, and a basal diameter of 10–16 μ. The stouter forms, in which the distal ray has a distinctly fusiform outline, as in the figure, are the typical spicules, although slenderer forms in which the distal ray is nearly cylindrical occur. The ray ends above in a terminal cone, and the upwardly projecting scales are narrow and sharp. These degenerate in the lower third of the ray to prickles, below which the ray is smooth. The scales in the thickest part of the ray have a length, measured along their upper border, of about 16 μ. The tangential rays are 40–50 μ long and 8–12 μ thick; about cylindrical and then suddenly curving to the point; with a few scattered, sharp, microtubercles. On the surface of the peduncular part of the body, only a few pinuli remain, and over much of the dermal surface they have been lost. On the gastral surface and on the uninjured parts of the dermal surface, they are thickly crowded.

In the walls of the larger canals a few canalar pinuli are to be found. They are of the same general type as the dermal and gastral pinuli, but with a shorter and relatively more slender distal ray.

Macramphidiscs of the type shown in Fig. 2, Plate 3, are very abundant in the dermal and gastral membranes. The shaft is smooth, and the umbels closely approach the equator of the spicule. The umbels are wide, evenly rounded, not truncated apically, and include 8 tongue-shaped rays, which are rounded at the free end. A typical spicule has the following measurements: total length of spicule, 160 μ; width of umbel, 100 μ; depth of umbel, 70 μ; greatest width of umbel ray, 24 μ. The total length of the spicule commonly varies from 120 to 180 μ, but larger spicules are exceptionally found which reach a length of 200 to 250 μ. The umbel rays are sometimes not strictly rounded at the free end, but round-pointed, and occasionally even sharp-pointed.

Mesamphidiscs having the character shown in Fig. 6, Plate 3, are abundant in the walls of some of the canals, and are scattered in the parenchyma. The shaft bears small, scattered, irregular tubercles, often a circle of tubercles, in the middle. The umbel has a deep bell shape, and is more than $\frac{1}{3}$ the total length of the spicule. The umbel rays are 8 in number, long, narrow, and pointed. A typical spicule has the following measurements: total length, 60 μ; length of umbel, 24 μ; width of umbel, 20 μ. The total length of the spicule varies from 40 to 65 μ.

Micramphidiscs of the common Hyalonema type, 25 to 30 μ long, are fairly common in the parenchyma. Transitional forms between these and the mesamphidiscs are easily found.

The skeletal resemblances between this species and *Hyalonema bianchoratum*, sp. nov., are striking, involving as they do the characteristic spicules, macramphidiscs, dermal pinules, and oxyhexacts (comp. Plate **2**, Figs. 2, 5, 10, and 11). Nevertheless the form of body is very different in the two species, and in *H. bianchoratum* there are two types of macramphidisc. Moreover, the macramphidisc of *H. pedunculatum* never assumes the shape with truncated poles and flattened sides which is common in *H. bianchoratum* (Plate **2**, Fig. 1). The resemblance is thus only partial, although close in the parts concerned.

Hyalonema bianchoratum, sp. nov.

Plate 2, Figs. 1-11.

Diagnosis. Body cup-shaped with deep gastral cavity. Numerous efferent canals open independently on the gastral surface; their apertures covered in by the gastral membrane. Micro-oxyhexacts with minutely denticulate rays about 50 μ x 4 μ; rays commonly slightly curved or straight. Dermal and gastral pinuli are alike, and pentacts; distal ray 250–530 μ long, comparatively stout, with long appressed upper spines and outwardly projecting lower spines, with a terminal cone. Macramphidiscs of two types. In one type the umbel is $\frac{1}{4}$ to $\frac{1}{3}$ total length, with acutely pointed rays; umbel width greater than its depth; total length about 450 μ. In the other type umbels closely approach equator of spicule; rays rounded at the end; umbel wider than deep; total length, 150 μ–250 μ.

Station 3415, one specimen.

Sponge body (Plate **2**, Fig. 6) is cup-shaped and, possibly owing to packing, is laterally compressed. The entire cup is 50 mm. deep, and has a greatest width of 75 mm. The cavity of the cup is 30 mm. deep, and the wall about 12 mm. thick. The wall thins away toward the free edge, but a marginal fringe separating the inner or gastral surface from the outer or dermal surface, is not present, possibly owing to the bad preservation of the specimen. The root spicules have been pulled out. The wall of the cup is excavated by numerous canals 4 mm. and less in diameter, and the consistency of the sponge is soft and flabby. The dermal membrane is badly injured, the gastral membrane less so. The latter is not separated from the sponge tissue, but simply passes over the apertures of numerous efferent canals.

The parenchymalia principalia are chiefly oxydiacts, which vary greatly in size and considerably in details of shape. There are many slender, often slightly curved, nearly cylindrical forms, with slight enlargement at or near the middle showing an axial cross. Common sizes are 1.5 to 2 mm. long by 20 μ thick. The ends are sometimes rounded and slightly enlarged. The spicule really tapers slightly from the middle toward the ends, and when the length is short (0.5 to 1 mm.) the outline becomes noticeably fusiform.—— There are some similar but much larger forms, connected by intermediate stages with the above. These may reach a size of 6 mm. x 34 μ. There is no median enlargement.—— There are other stouter diacts of a distinctly fusiform shape, ranging in size from 600 μ x 20 μ to 1350 μ x 60 μ. These exhibit an enlargement with axial cross. The enlargement may be faint or conspicuous, and may or may not extend quite round the spicule. This diact is not common in the interior, but is the predominating form at the dermal and gastral surfaces.

Other principalia are smooth oxyhexacts, which are scattered through the parenchyma in some number. The rays, which are not always of the same length, commonly range from 200 to 850 μ in length. A considerable number of large forms are present, having a ray length up to 3.5 mm.

The hypodermal and hypogastral pentacts are alike, and are strong, smooth oxypentacts, with no remnant of the distal ray. The tangential rays commonly vary in length from 350 to 850 μ. The proximal ray may be somewhat shorter than, or two or three times as long as, the tangentials.

Micro-oxyhexacts are abundant throughout the parenchyma. The spicules are strong spicules with rays 40–60 μ long and 3–4 μ thick at the base; commonest size of ray about 50 μ x 4 μ. Very minute, sharp denticulations are scattered along the ray, which tapers to a fine point. Spicules the rays of which are slightly curved, as in Plate 2, Fig. 10, predominate, but abundant straight-rayed spicules (Plate 2, Fig. 11) occur, and not infrequently spicules are met with in which the rays are conspicuously curved as in Plate 2, Fig. 9. When the rays are curved, the curvature is of the usual character, *viz.* opposite rays of a diameter are bent in opposite directions.

The dermal and gastral pinuli are alike, and are pentacts. The distal ray (Plate 2, Figs. 2, 3) is comparatively stout, ending above in a terminal cone. In the upper half of the ray the spines are long, narrow, and appressed. Below they are shorter and project outward in hook-like shape, degenerating farther down into a few prickles. The lowest part of the ray is smooth. The tangential rays bear a few scattered, sharp microtubercles. The range of size is considerable. Large spicules are abundant (Fig. 2, Plate 2) in which the distal ray is 530 μ long, with a greatest thickness of 64 μ and a basal thickness of 24 μ; tangential rays, 44 μ x 16 μ; spines on distal ray reaching a length of 40 μ, measured along their upper border. Smaller spicules (Fig. 3, Plate 2) are abundant down to a size in which the distal ray is 250 μ long, with greatest thickness of 32 μ, and a basal thickness of 10 μ; tangential rays, 30 μ x 10 μ. Still smaller sizes (Fig. 4, Plate 2) occur, although not commonly, in which the distal ray may be only 175 μ long. Some of the shortest spicules have tangential rays as long as are met with in any of the pinuli, the length reaching 60 μ. Although the size of the pinuli varies within such wide limits, the *character* remains fairly constant. The character is expressed especially in the terminal cone, the long and narrow appressed upper spines, and the lower hook-like spines.

The macramphidiscs are of two types. The first type of macramphidisc, Fig. 8, Plate 2, is only moderately abundant. It occurs, in the present condition of the specimen, both at the surface and in the interior. The shaft is slightly expanded, not always symmetrically, at the middle, and is smooth or bears one or two scattered small, sharp protuberances. The umbel is rather evenly rounded, although somewhat truncated at the apex, where there is a depression. It is considerably wider than deep, and its depth is from $\frac{1}{4}$ to $\frac{1}{3}$ the total length of the spicule. There are 8 rays which are acutely pointed. The variation in size is not great, and a typical spicule has the following measurements: total length, 455 μ; depth of umbel, 122 μ; greatest width of umbel, 188 μ; greatest width of umbel ray, 36 μ; thickness of shaft, at the middle of spicule, 30 μ.

The second type of macramphidisc is more abundant. It occurs especially at the surface, or in the peripheral parenchyma. In this spicule

(Figs. 1 and 5, Plate **2**) the shaft is smooth and only slightly thickened at the middle. The rays, 8 in number, are wide, tongue-shaped, rounded at the free end, and closely approach the equator of the spicule, rays of opposite umbels alternating. There is a depression at each pole of the spicule. The precise shape of the umbel varies. In many spicules (Fig. 5, Plate **2**) it has an evenly rounded outline, while in others (Fig. 1, Plate **2**) it is truncated at the pole and flattened on the sides. The two varieties shade into each other. A typical spicule with evenly rounded umbel has the following measurements: total length, 188 μ; depth of umbel, 80 μ; greatest width of umbel, 128 μ; shaft, 18 μ thick at the middle. A typical spicule with truncated and flattened umbel has the following measurements: total length, 210 μ; depth of umbel, 95 μ; greatest width of umbel, 152 μ; shaft, 20 μ thick at the middle.

Mesamphidiscs (Fig. 7, Plate **2**), 60–80 μ long, are present, but in small number, in the parenchyma. The shaft bears scattered, minute, sharp denticulations, and often but not always a circle of somewhat larger similar protuberances at the middle. The umbels are deep bell-shaped, slightly deeper than wide, and a little more than $\frac{1}{3}$ the total length. The umbel rays are 8 in number, rather narrow, and with pointed free end. A typical spicule measures: total length, 80 μ; umbel depth, 36 μ; umbel width, 30 μ.

Smaller amphidiscs, micramphidiscs, agreeing in shape with the mesamphidiscs, are scantily present. They range down to a total length of 28 μ.

Hyalonema, species diversae.

Plate 2, Figs. 12–16.

Under this heading I briefly describe several specimens so fragmentary that the shape of body cannot be inferred with any approach to certainty. The skeletal elements of them all, especially of the forms designated *Hyalonema 1* and *Hyalonema 2*, offer close resemblances to those of *H. bianchoratum.*

Hyalonema 1.

Station 3381, a fragment, apparently from the lower end of the sponge, including a part of the bundle of root spicules and surrounding tissue. The bundle of root spicules in its thickest part has a diameter of 5 mm., and the larger spicules a diameter of 700 μ.

The micro-oxyhexacts agree with those of *H. bianchoratum.*——The dermal pinules also resemble those of the latter species, differing only in that the upper spines on the distal ray are somewhat longer, the ray thus appearing more bushy.——There are two types of macramphidisc essentially like those of *H. bianchoratum.* In the case of the larger type, the total length reaches 510 μ; the shaft bears 3 or 4 scattered sharp microtubercles; the depth of the umbel is $\frac{1}{3}$ the total length; spicule fairly abundant. In the case of the shorter type, the umbel rays commonly reach equator of spicule, often slightly interdigitating; total length reaching 255 μ; larger sizes of the spicule truncated at the poles and with flattened sides, as in Fig. 1, Plate **2.**——The smaller amphidiscs, 24–70 μ long, do not differ from those of *H. bianchoratum.*——Acanthophorae are present and include stauractines and diactines. Spicules are spinose only at the ends of the rays; ends often rounded and enlarged, also pointed. The spiculation indicates that the fragment belongs to *H. bianchoratum,* perhaps representing a local variety of this species.

Hyalonema 2.

Station 3414, a fragment from the peripheral part of the sponge including both dermal and gastral surfaces, and about 50 mm. wide with a greatest thickness of 20 mm. On the gastral surface are the apertures of several canals about 7 mm. wide.

The micro-oxyhexacts agree with those of *H. bianchoratum,* but forms with straight rays predominate.——The pinules of the dermal and gastral surfaces agree closely with those of *H. bianchoratum.*——There are two types of macramphidisc, shown in Figs. 13 and 16, Plate **2**, which differ only in minute details from the macramphidiscs of *H. bianchoratum.* In the larger type, Fig. 13, the total length is 250–320 μ; shaft smooth or with a few scattered sharp tubercles and often with 4 or 6 protuberances at the middle. A typical spicule measures: total length, 280 μ; depth of umbel, 90 μ; width of umbel, 130 μ. In the smaller type, Fig. 16, the total length is 100–150 μ; rays of opposite umbels often slightly interdigitating at the equator of spicule. The umbels are never conspicuously truncated and flattened as in many of the spicules of *H. bianchoratum* (Fig. 1, Plate **2**). A typical spicule measures: total length, 144 μ; depth of umbel, 70 μ; width of umbel, 100 μ.

In addition, amphidiscs of the type shown in Figs. 14 and 15, Plate **2**, are fairly abundant. The total length is 150–180 μ; umbel depth varying from $\frac{1}{4}$ nearly to $\frac{1}{3}$ total length; shaft with a few scattered tuberosities, and frequently but not always with a ring of tuberosities at the middle. The umbel is often evenly rounded, as in Fig. 15, but as frequently somewhat truncated at the poles and flattened along the sides, as in Fig. 14. These spicules, which owing to their size may be regarded as a third type of macramphidisc, pass through intermediate stages into very similar mesamphidiscs, 60–80 μ long, in which the umbel depth somewhat exceeds $\frac{1}{3}$ the total length. —— The mesamphidiscs are connected by transitional forms with micramphidiscs, 18–20 μ long, of the character usual in *Hyalonema.*

The skeletal resemblances to *H. bianchoratum* are extensive and close. The only important point of difference is afforded by the third type of macramphidisc, which might properly be designated as an enlarged mesamphidisc, since it is connected by an unbroken series with the latter.

Hyalonema 3.

Station 3414. Three fragments, all including the lower end of the sponge with the root tuft.

The largest piece is a laterally compressed triangular mass 45 mm. wide by 50 mm. high. The root tuft where it adjoins the sponge is 5 mm. thick, and includes about 25 spicules varying in thickness from 200 μ to 730 μ. The spicules are all broken off below, the fragment of root tuft measuring 100 mm. in length. The tuft bears no anemone. At the base of the body there is a conspicuous firm and dense collar-pad surrounding the root spicules. —— The other two fragments are likewise laterally compressed triangular masses, but from smaller sponges. The upper diameter of the root tufts is something less than 2 mm., and the spicules do not exceed 250 μ in thickness. Again the lower ends are all broken off, although the tuft in one case is 200 mm. long. Both tufts at the upper end are surrounded by small *Palythoa* colonies, each including two individuals. In these specimens the basal collar-pad has not developed. —— It is noteworthy that in all three specimens the lower end of the sponge body has a triangular outline, and is laterally compressed to a marked degree.

The surface is so injured that it is not possible to reach a conclusion as to the character of the dermal pinuli. —— The micro-oxyhexacts, which are abundantly scattered throughout the parenchyma, are small slender forms (Fig. 12, Plate 2) with rays 30–36 μ long by 2 μ at the base, tapering gradually to the point. Rays are faintly roughened, almost smooth; slightly curved or straight, both types common.—— Two types of macramphidisc quite similar to the spicules of *Hyalonema 2*, which are shown in Figs. 13 and 16, Plate **2**, are sparsely present.—— A third type of macramphidisc, quite like the spicule of *Hyalonema 2*, which is represented in Figs. 14 and 15, Plate **2**, is present in great abundance. The spicule measures 150–180 μ in length, and is connected by abundant transitional forms with similar mesamphidiscs 40–60 μ long. **Micramphidiscs**, of the usual character, 16–20 μ long, are abundant.

The similarity to *Hyalonema 2* afforded by the amphidiscs is striking.

Mention may here be made of imperfect tufts of root spicules taken at Stations 3381 and 3399. The spicules resemble those of the specimen of *Hyalonema pateriferum* from Station 3376.

Hyalonema pateriferum, sp. nov.

Plate 1, Figs. 1-13.

Diagnosis. Body obconical to saucer-shaped, the upper surface approximately flat, the under surface very or moderately convex. No main gastric cavity, but instead a comparatively large number of efferent canals covered in by the gastral membrane. Root spicules thick, about 1 mm. in diameter. Characteristic micro-oxyhexacts with slender, curved, and minutely denticulate rays 30–45 μ long. Dermal pinules, slender forms; distal ray, 150–200 μ long, ending in a slender point. Characteristic macramphidiscs 100–200 μ long, with smooth shaft and umbels which have the shape of wide, shallow bowls; depth of umbel about $\frac{1}{5}$ the total length, or shallower.

Station 3376, 1 specimen; *Station 3363*, 1 specimen and 3 fragments; *Station 17* of the "Albatross" 1900 cruise, 2 specimens.

In the specimen from Station 3376 (Figs. 12 and 13, Plate **1**), the body is irregularly obconical, and is somewhat compressed in one of the morphological horizontal diameters. The root tuft emerges from one side of the base, and exhibits an open spiral curvature. The general asymmetry is doubtless an individual feature, associated with the position assumed by the animal in its habitat. If in the natural position the root tuft was vertical, then the body of the sponge probably lay under a stone or some such object, the gastral face looking out from under this protection. The sponge body is 65 mm. high and has a greatest width of 90 mm. The root tuft is 330 mm. long, 6 mm. thick, near the body, and includes about 50 spicules, most of which are thick, having a greatest diameter of about 1 mm., although much slenderer ones are intermingled. At its base the tuft is embraced by a single *Actinia*-like anemone of a yellow-brown color and firm leathery consistency.

A marginal ridge is sharply defined round the greater part of the gastral surface. The membrane covering the gastral surface is in general a typical reticulum, but in places near the periphery of the surface the reticulum is not developed, the membrane here appearing to the eye dense and perforated only by scattered oscula about 1.5 mm. in diameter. The membrane covers in a relatively large number of efferent canals, the transverse diameter of which at the surface is 5–10 mm. These canals extend more or less vertically into the body, and largely excavate it. Some of them are easily traceable from the gastral surface to the base of the body. The dermal membrane, covering the lateral surface of the body, is a reticulum with a somewhat finer mesh than the gastral membrane. Over a considerable part of the surface the dermal membrane has been abraded, disclosing the canals beneath. These, presumably afferent, canals are in general smaller than the canals opening on the gastral surface. At the base of the body there is a rather inconspicuous collar-pad, surrounding the root tuft and containing the characteristic acanthophorae.

The entire specimen from Station 3363 is a saucer-shaped mass, with a flat upper and convex lower surface. The root tuft has been torn out, leaving an evenly bounded aperture, 6 mm. wide, about in the centre of the lower surface. The sponge body has a depth of 40 mm., the horizontal diameters being respectively 85 mm. and 65 mm. In other respects, the description given of the specimen from Station 3376 applies to this specimen.

The better specimen from Station 17 (1900 cruise) resembles in essential shape the one from Station 3363, but is even flatter. The depth is 15 mm., the horizontal diameters respectively 80 and 60 mm. The root tuft has again been torn out, leaving a somewhat irregular aperture 7 mm. in diameter. The gastral membrane, covering the upper surface, appears continuous and not reticular, the probable explanation being that the apertures are closed. The dermal membrane, covering the under surface, is reticular as in the other specimens. Toward the periphery the body thins away to a sharp margin, which is somewhat injured. The other specimen from this station is fragmentary, but appears to have belonged to a much-flattened sponge similar to the one just described. It is of course possible that in the packing these specimens have been artificially flattened. There is, however, every indication that the present shape is approximately the natural one.

The parenchymal macroscleres are oxydiacts and oxyhexacts. The oxydiacts are very abundant, scattered in all directions through the parenchyma, chiefly in tracts, but also singly. They are smooth, with or without a median swelling, the rays tapering evenly to points. The size varies from 500 μ long by 8 μ thick, near the middle, to 3 mm. long by 28 μ thick. —— The oxyhexacts are few in number. The rays are smooth, straight, and tapering, measuring in a typical case 700 μ long by 48 μ thick at the base. The hypodermalia and hypogastralia are alike, and are smooth oxypentacts and oxydiacts. The oxypentacts are abundant, with no trace of the distal ray, the other rays tapering to points. They vary in size from small ones with tangential rays 150 μ x 12 μ to large ones with tangential rays 600 μ x 48 μ. The proximal ray is in general longer than the tangential rays, but on the gastral surface it is sometimes shorter. —— The diacts are abundant, sharing with the tangential rays of the pentacts in forming the supporting reticulum of the surface. They are similar to the diacts of the interior.

The common and characteristic form of parenchymal microsclere is a micro-oxyhexact with slender, curved, and minutely denticulate rays, 30–45 μ long and 2 μ thick at the base (Fig. 9, Plate 1). The denticulations are sharp and just perceptible, with a power of 600 diameters. The curvature is well marked. Mingled with these are a good many similar oxyhexacts, in which the ray is either straight (Fig. 8, Plate 1) or shows only a very slight curvature. These average a larger size, the ray length being 40–60 μ. Oxyhexacts and oxypentacts with straight, minutely denticulate rays, 60–80 μ long, are found sparsely in the parenchyma, and in or near the walls of some of the canals. They are probably in all cases canalaria.

The dermal pinules (Fig. 3, Plate 1) are slender spicules, in which the distal ray ends in a pretty long slender point ("endspitze"), and bears sharp spines, which are not thickly crowded. The lower part of the distal ray, $\frac{1}{4}$ to $\frac{1}{3}$ the total length, is smooth. The tangential rays are smooth, or nearly so, and pointed. There is no trace of the proximal ray. The distal ray is commonly 150–200 μ long, with a basal thickness of 5 μ; tangential rays 30–40 μ long. Spicules in which the distal ray is only 100 μ long, or as long as 220 μ, occur. The pinules are abundant, and their tangential rays rest upon the reticulum formed by the hypodermal diacts and the tangential rays of the hypodermal pentacts.

The gastral pinules are in general like the dermal pinules; but long, very slender forms of the type shown in Fig. 2, Plate 1, occur. In these spicules the spines on the distal ray are so reduced in size as to be mere prickles. The distal ray is 300–400 μ long; tangential rays about 40 μ long. Transitional forms between these and the ordinary type of pinulus occur. The gastral pinules are arranged in the same way as the dermal.

Canalar pinules are rather sparsely scattered over the walls of the larger efferent canals. They are similar to the common type of dermal and gastral pinulus, but are somewhat shorter. The distal ray is 110–150 μ long; tangential rays 40 μ long. Only a comparatively small percentage of the spicules rest upon the underlying diacts.

The marginal ridge is well preserved in only one specimen, that from Station 3376. Oxydiacts (marginalia) in considerable number project radially from the ridge. Many are like the common hypodermal diact; *i. e.*, smooth and enlarged at the middle. Others are specialized marginalia, in which the outer projecting half is covered with small, sharp spines, while the inner half is smooth (Fig. 1, Plate 1). An occasional prickle is found in some spicules on the inner half. A typical spicule is 700 μ long and 12 μ thick near the middle. This form of marginal diact is shorter and slenderer than the common sizes of the smooth form.

The characteristic macramphidisc of the species is shown in Figs. 5, 6, and 7, Plate 1. The shaft is ordinarily smooth, very rarely with one or two rounded protuberances at the middle. The umbels have the shape of wide shallow bowls; depth of the umbel about $\frac{1}{5}$ total length of the spicule, or less; umbel rays 8 in number, broad and leaf-like, pointed. In the specimens from Stations 3376 and 3363 the macramphidiscs are alike. In these specimens the total length of the spicule is 100–200 μ; thickness of the shaft at the middle 8–16 μ; depth of the umbel varying somewhat, but close to $\frac{1}{5}$ the total length. One of the smaller sizes is shown in Fig. 5, one of the larger in Fig. 6.——In the specimens from Station 17 (1900 cruise), macramphidiscs occur that are similar to those of the other specimens, but in most of the spicules the umbels are very shallow, and with noticeably flat tops. The umbel depth is commonly about $\frac{1}{7}$ the total length. The total length is the same as in the other specimens. A typical macramphidisc of this specimen is shown in Fig. 7, Plate 1.—— The macramphidiscs are very abundant in the dermal and gastral membranes of all specimens. A few are found in the internal parenchyma, but this position may not be natural.

Mingled with the characteristic 8-rayed macramphidiscs are a considerable number of amphidiscs of the type shown in Figs. 10 and 11, Plate 1. The umbel is usually 4-rayed, but umbels with 5 and 6 rays occur. The shaft is smooth, and the umbel rays very similar to those of the 8-rayed form. The spicule varies somewhat as regards the precise shape of the umbel, which in some spicules (Fig. 10) is deeper than in others (Fig. 11). The total length is 60–100 μ. It is possible that these spicules represent young stages of the 8-rayed form.

Mesamphidiscs (Fig. 4, Plate 1), 50–80 μ long, are abundant. The shaft bears scattered small tubercles in varying number. The umbel is deep bell-shaped, with 8 pointed and rather narrow rays. The umbel depth is slightly more than $\frac{1}{3}$ the total length.

Micramphidiscs of the common *Hyalonema* type, 20–25 μ long, are abundant. Intermediate forms between these and the mesamphidiscs are common, and especially abundant in the walls of the main efferent canals.

Pathological amphidiscs of small size are occasionally observed, similar to those described by Marshall and Meyer, 1879, p. 261, Taf. XXV Figs. 19, *a*, *b*, *c*. In one such, which measured 72 μ in total length, 3 rays of the hexact had developed umbels which were not quite alike, one ray was club-shaped at the end, and a fifth ray had the form of a short spine.

The lower end of the body is well preserved in only one specimen, that from Station 3376. The collar-pad here bears on its outer surface the ordinary dermal skeleton, but round the root spicules there is a thick dense layer of acanthophorae. In these, only the ends of the rays are spinose. The ends are frequently but not always slightly enlarged. The spicules include diacts, tauacts, stauracts, pentacts, and hexacts. Stauracts with subequal or very unequal rays are the commoner forms. In a representative diact, the total length is 900 μ. In a typical stauract the length of the longest ray is 250 μ.

The basalia vary in greatest diameter from 130 μ to 1 mm. The spicules in their lower portions taper rather rapidly and over a considerable distance, 60 mm. or so, exhibit the well-known annular ridges. The lower ends are broken off.

Of the known species of *Hyalonema,* the form here described stands nearest *H. conus* F. E. Sch. (Schulze, 1887, p. 209; 1893, p. 35). A precise point of difference concerns the micro-oxyhexacts which in *H. conus* have straight and distinctly roughened rays 50–60 μ long. The pinules and macramphidiscs are very similar in the two species, although in *H. pateriferum* the macramphidisc umbels are wider and shallower, especially in the specimens from Station 17 (1900 cruise).

HEXASTEROPHORA F. E. Schulze.

EUPLECTELLIDAE Gray.

Euplectella Owen.

1841. *Euplectella* Owen, 1841, pp. 3–5.
1887. *Euplectella* Owen, Schulze, 1887, p. 53.
1901. " " Ijima, 1901, pp. 37–58.

Euplectella, sp.

Plate 4, Fig. 4.

Station 3404, 6 imperfect specimens. The specimens include only the dictyonal framework, with no free spicules, and thus a closer identification is impossible.

The specimens represent in all cases the lower part of the body, which is somewhat curved and tapers to the inferior apex. The paragastric cavity is limited below by a "bottom plate." The extreme lower end of the body is worn in most of the specimens, but in one the longitudinal bundles of the wall are continued below the body, curving toward one another so as to form a conspicuous cone, which extends 6 mm. below the bottom plate.

The wall is made up of the longitudinal, transverse, and oblique silicious strands characteristic of *Euplectella,* all firmly united together by exceedingly numerous synapticula. The longitudinal tracts on the outer surface are strongly, whereas the transverse tracts on the inner surface are feebly, developed. Along the former, and also along the oblique tracts, are here and there developed isolated protuberances, which in places are united to form parietal ridges. The parietal apertures are rounded and for the most part arranged in fairly regular transverse or oblique rows.

The specimens are of interest in that the cavity of the sponge is crossed by one or more horizontal or oblique septa. The septa (Fig. 4, Plate 4) are obviously similar structures to the well-known "bottom plate," which has been observed in several species of *Euplectella* (Schmidt, 1880, p. 60; Schulze, 1895, p. 17; Schulze, 1902, p. 53; Ijima, 1901, pp. 40, 92, 103, 207). The septa are spongy, easily broken, and composed of a reticular tissue formed by the continued deposition of silica chiefly round small diacts, with the development of synapticula. The diacts discernible in the beams of the reticulum have rounded and slightly enlarged ends. The proper skeletal strands of the sponge wall take no share in forming the septa.

In the specimen figured the septa are arranged one above the other. In the other specimens there is but one septum. The septa are thicker at the periphery, thinning out toward the centre. Except in one case they are perforated by several rounded apertures, about the size of the parietal apertures. In the case referred to, the septum is imperforate, but is exceedingly thin in spots. On its upper surface the reticular beams have a predominantly radial disposition, and moreover are vaguely divided into groups, each of which radiates from a particular part of the body wall. This arrangement suggests that the septum arises as a number of centripetal outgrowths from the wall, the outgrowths meeting and coalescing. And in fact, in the specimen figured, three independent outgrowths of this character, all lying in the same transverse plane, exist above the uppermost septum.

The reticular tissue of the septa, at the periphery of the latter, is prolonged as a thin unevenly developed layer over the adjacent parts of the sponge wall. In some of the specimens, in which there are no septa, this reticular layer is developed over extensive areas of the gastral surface, and in a less degree over the outer surface. In such places the tissue is thick enough to hide completely from view the proper composition of the wall, passing over and so closing the parietal apertures.

The union of the smaller parenchymalia into a finely reticulate tissue, which in the one case spreads over the surface of the sponge, and in the other crosses the paragastric cavity, would seem to be everywhere essentially the same phenomenon, perhaps having a definite physiological function. The structure of the "bottom plate" in the specimens studied is similar to that of the septa.

Regadrella O. Schmidt.

1880. *Regadrella phoenix* O. Schmidt, 1880, p. 61.
1887. *Regadrella* O. Schm., Schulze, 1887, p. 84.
1901. " " Ijima, 1901, p. 220.

Regadrella, sp.

Plate 9, Fig. 9.

Station 3380, two fragmentary specimens including only the macerated skeletal framework.

In both specimens the base is preserved with the lower part of the tube wall. The better specimen is figured (slightly above the natural size, owing to an accident in the taking of the photograph). In the other specimen the base is smaller, and less of the wall is included. The base in each is a nearly flat plate with few irregularities. The skeletal strands forming the wall are cemented together at the points of crossing, and the wall as a whole is somewhat flexible and elastic.

I have had for comparison specimens of *R. okinoseana* Ijima and *R. phoenix* O. Schm. As compared with the former species, and in a less degree as compared with the latter, the "Albatross" specimens are remarkable for the thin character of the parietal strands and the consequent large size of the meshes. As compared with the only other species of *Regadrella* the whole body of which is known, *R. kameyamai* Ijima, it would seem from Ijima's description (1901, p. 257) that the parietal strands in my specimens undergo a more extensive fusion. These specimens again differ from the described species of *Regadrella* in the greater regularity of arrangement displayed by the skeletal strands. On the gastral surface the obliquely transverse beams, which are very strongly developed, are arranged parallel to one another. Crossing them at about right angles are ascending bundles. The meshes would thus be squarish, but oblique fibres extending both to the right and left cross the meshes usually at the corners, thus giving rounded apertures. The oblique fibres may cross the middle of the mesh in such a way as to obliterate the aperture. The arrangement of the skeletal strands thus approaches the regularity found in *Euplectella.*

The coarser skeletal strands are made up, each, of one or a few large diacts surrounded by very slender diact comitalia, all united by and covered with cement. The principal diacts are 120 μ or somewhat less in transverse diameter, tapering gradually toward the ends, which are apt to break off or remain concealed in the cement. The comitalia are very slender, often only 6 or 8 μ thick. The length of the principalia may exceed 20 mm., and they are frequently though not always bent at the middle, as in the similar spicules of *R. phoenix* (Schulze, 1899, p. 21).

The reticulum of silicious beams constituting the basal plate presents no peculiarly characteristic features, agreeing in general with the description given by Ijima (1901) for *R. okinoseana* and *R. kameyamai.*

Regadrella delicata, sp. nov.

Plate 3, Figs. 7, 8. Plate 4, Figs. 2, 11.

Diagnosis. The marginal spicules round the sieve-plate are stauracts, the longitudinal axes of which are not included in the skeletal bundles of the body wall. The superior rays of the stauracts are accompanied by slender parenchymalia, not by the parenchymalia principalia. Species close to *Regadrella phoenix* O. Schm., agreeing with it in general spiculation.

Station 3404, one specimen.

The specimen is fragmentary, including a part of the lateral wall of the sponge, which had been ripped open longitudinally. In packing, the piece was compressed so that it reached me in the shape of a folded plate, the line along which the folding had taken place corresponding with the long axis of the sponge. This plate-like fragment had a length of 150 mm. and a greatest width of 50 mm. Its upper edge is formed by the margin of the sieve-plate area, and seems to be uninjured. The dermal and gastral surfaces of the lower part of the piece are shown in Fig. 11, Plate 4.

When the two halves of the specimen, which had been folded together, were separated, some idea of the natural shape of the sponge was obtainable, and it could be seen that the sac tapered markedly toward its upper end. The upper edge is 25 mm. long. How much of the natural periphery of the sieve-plate area this represents could not be ascertained, although the curvature of the wall indicates that it represents a very large part.

The wall of the sac is thin, about 1.5 mm. thick. The rounded parietal apertures are mostly 2 to 1.5 mm. in diameter, except in the extreme upper part of the sponge, where the diameter is very commonly about 1 mm., although much smaller apertures are here present. The apertures exhibit an imperfect arrangement in oblique or nearly transverse rows, and are mostly 3–5 mm. apart; more closely crowded in the upper part of the sponge, where the interval is 2 mm. to 0.75 mm. On both dermal and gastral surfaces, the small apertures of the numerous canals, 0.5 mm. and less in diameter, give the sponge a porous appearance.

The gastral surface is smooth, and the dermal surface, which is without prostalia, exhibits no elevations, except that as in other species of the genus the coarse skeletal bundles project. These latter bundles pursue a nearly longitudinal or somewhat oblique course, converging toward the lower end of the fragment, where there are some cases of anchylosis. Elsewhere there is no, or only the feeblest anchylosis. The obliquely transverse bundles on the gastral surface are not large enough to cause elevations of the gastral membrane. In the uppermost part of the body the transverse arrangement of these bundles is more marked than elsewhere.

The spiculation agrees with that of *R. phoenix* as described by Schulze (1887, p. 84; 1895, p. 34; 1899, p. 20) and Ijima (1901, p. 265), except in a few details. And the close resemblance to *R. phoenix* possibly indicates that the specimen represents a late stage in the development of that species.

The principal diacts, smooth and tapering to a point at each end, bent at the middle or more evenly curved in bow-like shape, reach a diameter of 300 μ and a length of 30 mm. There are abundant smaller sizes down to 12 mm. x 170 μ, below which still smaller spicules with the characteristic shape down to 6.5 mm. x 90 μ are found.

The slender cylindrical comital diacts of various lengths are mostly 6–8 μ thick. They are swollen in the middle, and usually with subterminally roughened ends, which are often but not always enlarged. Similar diacts, 6–30 μ thick, constitute the smaller bundles or lie loose in the parenchyma. Other small parenchymalia, intermediate between the diact and hexact condition, with cylindrical rays rounded at the ends, are also found. The tauact and stauract forms are the commonest.

The comital diacts are not cemented together over the principalia, and the latter are only loosely combined to form bundles. Many of the principal diacts lie scattered through the parenchyma, unassociated in bundles. Some of these are without comitalia, although in general so provided. To form a long bundle the ends of succeeding diacts overlap, and become covered with a continuous sheath of comitalia. Very commonly 4 or 5 diacts, each with its own sheath of comitalia, lie side by side, but separated by considerable intervals, thus forming a tract, but not a single bundle. Frequently such diacts in one part of their course will be closely bound together, while separate elsewhere. This is the commonest arrangement, although there are bundles consisting of 2 to 4 parallel diacts, which are closely bound together by comitalia throughout their length.

The principal diacts in the extreme upper part of the body average a smaller size than elsewhere, the larger ones here measuring only 10–13 mm. in length by 200–220 μ in thickness. Some of them exhibit the characteristic bend, which is frequently not at the middle, while others are gently curved or nearly straight. They are in general surrounded by relatively few comitalia and lie separately or in approximately longitudinal bundles composed of a few (2–4) spicules. In one part of the marginal region, about 5 mm. wide, the parietal apertures are scarcely developed, being here few and small and not rounded but irregularly elongated gaps. In this small region the principal diacts show what is probably the general arrangement before the apertures develop. They are here arranged close together in an approximately longitudinal direction, radiating toward the upper margin, reaching or nearly reaching or projecting slightly beyond this margin, and are without proper comitalia, although the slender diacts are present in abundance between them.

The dermalia are slender hexacts, which agree with the description given by Ijima (1901, p. 273) for *R. phoenix*. The short distal ray is cylindrical or only very slightly expanded, 6–8 μ thick, rounded at the end and with "obsolete microtubercles." Measurements of a characteristic spicule are: distal ray, 80 μ long; tangential rays, 160 μ long; proximal ray, 200 μ long; tangentials and proximal, about 8 μ thick at the base. Meshes of the dermal network formed by the tangential rays are in general square, 160–250 μ on the side, including 3 or 4 pores which are 50–110 μ in diameter.

In the upper part of the body, within a distance of 15 mm. from the margin, the dermal hexacts are much less uniform in structure than elsewhere. While spicules occur, like those which are common lower down, most of the hexacts are larger, stouter forms, in which the short distal ray is either rounded or pointed at the end, and the tangential rays taper conspicuously to points. Many sizes are found, ranging up from spicules, in which the rays are about as long but twice as stout as in the common dermalia, to large forms with tangential rays 600 μ ong and 65 μ thick. In the larger ones the tangential rays are commonly of unequal lengths. Some of these stout spicules are found here and there over the general surface of the body.

The gastralia are scattered. Pentacts answering to the description given by Ijima (1901, p. 275) for *R. phoenix* are common. The tangential rays are equal or unequal, and mostly 150 to 250 μ long by 10 to 12 μ thick. The proximal ray is longer, frequently 500–750 μ by 10–12 μ. Similar tauactines and stauractines are common. Hexact forms also are frequent, like the pentacts except that the small rounded boss is represented by a ray, which is usually much shorter than the tangentials, and is smooth, terminally rounded, cylindrical, or slightly enlarged, the greatest thickness sometimes reaching 16 μ. Gastralia similar to those here described are present in a specimen of *R. phoenix* from the Museum of Comparative Zoölogy.

Onychasters are abundant. The principal rays measure 4–6 μ, the terminals about 30 μ in length. The terminals are slender and tapering, usually 3 to a principal. The spicules differ from those of *R. phoenix* (Schulze, 1899, p. 21, Plate III.; Ijima, 1901, p. 216, Plate X.) in the size of the claws. In *R. phoenix*, according to Schulze's and Ijima's figures, the claws are fully 2 μ long. In my specimen the claws are 1 μ long and exceedingly fine. The difference, although one of degree, is easily noticed. In a preparation of *R. phoenix* (specimen in Museum of Comparative Zoölogy) I can observe the claws with a power of 300, and can study them very well with a power of 600. In my specimen, with the former power, all the spicules look like oxyhexasters, and even with 600 most of them present this appearance. To make sure of their general presence, it is necessary to use an immersion objective. In the spicule, only two claws can be made out on each terminal, and these project forwards.

A floricome is found in the immediate neighborhood of the distal ray of each dermal pentact. The spicules are like those of *R. phoenix* (Schulze, 1887, p. 85, Plate XIII.; Ijima, 1901, p. 276, Plate X.), but the size is something smaller than that given by Ijima, the diameter being about 80 μ.

Graphiocomes must be rare. I do not find any in my preparations, and only a very few rhaphides. Nor do I find any spicules peculiar to the border of the parietal apertures.

Over a part of the surface, as in the specimen of *R. phoenix* studied by Ijima (1901, p. 269), the hydranths of a commensal hydroid cause minute elevations. The elevations are not abundant nor conspicuous, although the opaque body of the hydroid catches the eye. As in Ijima's specimen very large and modified dermal hexacts, mingled with the common dermal hexacts, are found round the hydrozoan body. The spicules differ in some details from those found by Ijima (1901, p. 274, Plate X. Figs. 25–27). The distal ray is not club-shaped but cylindrical, beginning to taper near the upper end and running out to a point. The tubercles spread over its distal half. The tangential rays are sometimes short, as in Ijima's spicules, again almost as long as the distal ray, and they vary in length in the same spicule. The proximal ray is generally shorter than, but sometimes as long as, the distal ray. A fairly characteristic such spicule has the following measurements: Distal ray, 1 mm. x 85 μ; proximal ray, 500 μ x 50 μ; tangential rays, 500 μ x 50 μ to 200 μ x 50 μ. The spicules in a single clump vary in absolute size and in proportions of parts. For instance, in some cases a tangential ray is much the longest of all. Many intermediate sizes between the dimensions above given and the ordinary dermal hexact are to be seen. The preservation of the hydroid itself is very imperfect. But it can be seen that the form is a tubularian hydroid, that the hydranths have several tentacles, and are borne upon a slender branching stolon.

The sieve-plate region presents a simpler structure than in *R. phoenix*. The sponge ends above in a thickened margin which contains 6 large stauractines arranged in a ring (Fig. 7, Plate 3; Fig. 2, Plate 4). The superior rays of the stauractines project obliquely upward and centripetally, as if to form the radial beams of a sieve-plate. With the exception of one stauractine the superior ray of which is bare (Fig. 7, Plate 3), these rays are densely covered with the smaller parenchymalia, chiefly slender, cylindrical diacts 8–20 μ thick, mingled with which are small tauacts, stauracts, pentacts, and hexacts. These latter spicules, like the slender diacts, have smooth cylindrical rays, usually of unequal lengths in the same spicule, rounded or round-pointed at the ends, where they are frequently enlarged and subterminally roughened; rays, 34–225 μ long, 8–20 μ thick. The tip of the large stauract ray emerges from its covering.

Unlike the adult *R. phoenix*, no principal diacts accompany the superior rays of the large marginal stauracts. The inferior rays which extend longitudinally down into the sponge wall are unaccompanied by comitalia, and with the exception of one case are not in intimate association with particular principalia. In the case alluded to, Fig. 2, Plate **4**, the tip of the inferior ray is well overlapped by the two principal diacts of a longitudinal skeletal bundle. There is but one case of anastomosis between the bundles which are supported by the superior rays of the stauracts (Fig. 2, Plate **4**), and in only one of these bundles is there any evidence of an existing or beginning transverse connection. This bundle bears a laterally projecting small hexact (Fig. 2, Plate **4**). Whether the central ends of the bundles, which are supported by the superior rays of the stauracts, were connected in the living sponge, must remain an open question. It may be added, however, that the upper margin of the sponge and the surfaces of the bundles are smooth, and there is no indication in the specimen itself that anything has been torn away.

The marginal stauracts are 1.5 mm. to 3 mm. apart. The two rays corresponding to the proximal and distal of the dermal hexact are reduced to conical bosses. (This condition, instead of the pentact, is occasional in *R. phoenix* according to Ijima, 1901, p. 271.) The superior ray is always long, nearly cylindrical, tapering eventually to a point, smooth or with a surface made undulating by scattered low and rounded tubercles. The three other rays are smooth and taper gradually to a point. They vary greatly in absolute and relative lengths. The inferior ray may be the longest or much the shortest of the four developed rays. The lateral rays, lying parallel to the sieve-plate margin, may be equal or unequal in length, and very much shorter than or nearly as long as the superior ray. In the largest spicules the superior ray is 4.5 mm. to 4.8 mm. long and 250 μ to 300 μ thick at the base; the other rays having about the same basal thickness. Two of the marginal stauracts, one of which is shown in Fig. 7, Plate **3**, are much smaller than the others, the superior ray measuring about 2.4 mm. x 120 μ. The marginal stauractines, it will be seen, are small as compared with the larger of the corresponding spicules in *R. phoenix* (Ijima, 1901, p. 272, gives the combined length of the superior and inferior rays as reaching 30 mm.), and the rays vary more in relative length than in the spicules examined by Ijima.

The thickened margin representing the cuff of some other species is a band about 1 mm. wide. It consists chiefly of closely packed diacts, mostly slender forms 10 to 30 μ thick, with some larger ones up to 60 μ thick, arranged in large measure parallel to the free margin of the sponge. Mingled with these are some of the other common, small parenchymalia, intermediate between the diact and hexact conditions. The band projects on the gastral surface, and while larger, is essentially similar to the slender skeletal bands which elsewhere project on this surface. The marginal stauractines lie on the dermal side of the band.

In *R. phoenix* Schulze describes the margin of the sieve-plate area (1887, p. 84, Plate XIII.) as surrounded by large dermal hexacts, the long spinous distal rays of which project radially from the surface to a distance of about 5 mm. Ijima also finds enlarged dermal hexacts, which "lie crowded on the cuff edge" (1901, p. 275), but the spicules are much smaller, the distal ray measuring 1 to 1.25 mm. in length. Large dermalia of this character are not found in the marginal region of *R. delicata*, unless the single spicule shown lying on the marginal band in Fig. 7, Plate **3**, belongs in this category.

In the extreme marginal region of *R. delicata* many of the dermalia have probably been lost, but groups remain here and there. Among these are hexacts which do not differ from the common forms of dermalia found in the upper part of the sponge. Several such are shown in Fig. 8, Plate **3**. In the upper left corner a fairly typical dermal hexact is figured. Lower down lie other hexacts differing considerably in size and detailed character.

In some of the larger dermalia, near the margin, the distal rays are reduced to conical bosses, and the proximal rays are but little longer. A group of three such spicules is shown in Fig. 8, Plate **3** (to the right). The tangential rays here, as in the other enlarged dermalia, are subequal or strongly unequal. The condition of these spicules is not far from that of the marginal stauractines, and it seems probable that it is from them that the stauractines are recruited as the sponge increases in size. That is, the condition of the marginal region of this specimen suggests that an enlarged dermal hexact, in which one of the tangential rays is especially elongated, is from time to time pushed to the edge, the tangential ray in question becoming the projecting superior ray of the stauract.

ASCONEMATIDAE F. E. Schulze.

Caulophacus F. E. Schulze.

1887. *Caulophacus* F. E. Schulze, 1887, p. 124.
1897. *Caulophacus* " 1897, p. 6.
1903. *Caulophacus* F. E. Sch., Ijima, 1903, pp. 85, 112.

Caulophacus schulzei, sp. nov.

Plate 4, Figs. 1, 3, 5-10; Plate 5, Figs. 1-6, 8-10.

Diagnosis. Body of the usual character, and gray-brown in color. Dermal and gastral pinules are hexacts, which differ only in that the dermalia are slightly shorter and stouter than the gastralia. The usual spinose discohexacts and discohexasters are present. In the smooth discohexaster the terminals are commonly 5–10 in number, arranged in a whorl, and considerably longer than the principals.

Station 3382, 10 specimens; Station *3399,* 4 specimens.

The body (Fig. 3, Plate 4) varies from a disc shape to a distinctly calyculate shape, and has a diameter varying from 22 mm. to 50 mm., with a thickness, taken midway between the attachment of the stalk and the edge, of 3 to 6 mm. The thickness diminishes toward the edge, which is sharp. The dermal surface of the body — that to which the stalk is attached — is in several specimens distinctly convex, in other specimens flat or slightly concave. The opposite, or gastral surface, is in general slightly concave, but in some of the specimens it is slightly convex. In all cases the stalks are broken off near the body. There can be no doubt, however, that five of the six stalks that were in the same jars with the sponge bodies, belong to them. This is demonstrated by the agreement in spiculation, and in diameter and appearance, between the upper end of the detached stalk and the lower end of the fragment that is united with the body.

The stalk is more or less curved, slender, the diameter in the middle region ranging from 2 to 3 mm.; about cylindrical, but enlarging above and below. Below, the stalk makes an angle with its narrow, elongated base, the precise shape of which varies, although the surface of attachment is in all cases flattened. In the natural condition the base is evidently attached to the root spicules of *Hyalonema,* round which it grows. Fragments of some of the *Hyalonema* spicules remain, perforating the base in the direction of its long axis, also the parallel impressions left by others of these spicules on the attaching surface of the base.

The stalk enlarges at its upper end, where it passes into the body. Its connection with the body is always excentric, and except in two specimens oblique, as shown in the figure. In the two cases referred to, the remnant of the stalk projects vertically from the body. The body itself is heavy, and because of the numerous canals perforating it, is easily torn. The stalk is firm and hard, except in its uppermost region. Here, where there are no synapticula between the principal supporting spicules, it is comparatively soft and easily broken, although in the living specimen doubtless flexible. The attachment of the stalk to the *Hyalonema* root spicules shows that the body itself cannot, in the natural position, be far from the surface layer of mud. And this fact, taken together with the character of the uppermost part of the stalk, suggests that the disc rests upon the surface mud, something after the fashion of a *Renilla,* instead of projecting freely in the water.

Both surfaces of the body exhibit the apertures of very numerous canals, which pass vertically into the interior. They are about equal in abundance and size on the two surfaces, being smallest in the peripheral region. The diameter of the apertures ranges from less than 1 mm. to 2 mm., or in some individuals to 4 mm., and on both surfaces they are covered in by the dermal and gastral membranes respectively. The axial canal in the stalk is $\frac{1}{3}$ to $\frac{1}{4}$ the diameter of the stalk, widening greatly above where the stalk passes into the body, and opening into several smaller canals. In two specimens examined these canals pursued so intricate a course that I could not trace them to their openings. In another specimen the canals were larger and opened on the gastral surface, as described by Schulze for *Caulophacus latus* (1887, p. 124) and *C. agassizii* (1899, p. 37).

As in the other species of the genus, the principal parenchymalia are hexacts and diacts. The hexacts are distributed through the body of the sponge, where they are abundant but not crowded (Fig. 10, Plate 5). In the stalk they are few in number, and those seen lay outside the main diact skeleton. The hexacts are rather slender, with straight or gently curved rays which are often accompanied by a few diacts. The rays are smooth, taper evenly to rounded points, and in general are equal or subequal, measuring 700–1200 μ x 28–48 μ. Rarely hexacts are found in which all the rays are covered with sharp microtubercles. Such spicules seem to be modifications of the hypodermal pentacts.

The diacts of the body are slender, straight, or slightly curved; in general cylindrical, or somewhat thicker in the middle region and tapering toward the ends, which are enlarged, rounded, and subterminally roughened with microtubercles. The ends may not be swollen and may be smooth. Often, though not always, a trace of the lost rays is retained in the form of a slight annular thickening containing an axial cross. The spicules vary in length from 1 to 4 mm., in thickness from 8 to 12 μ. Lengths of 1.5 to 2.5 mm. are the commoner sizes. Exceptionally the diact is thicker and perceptibly fusiform, tapering evenly from the middle to the rounded smooth points. A typical spicule of this character measures 1700 μ x 24 μ. Bundles of diacts and, less commonly, separate diacts run in all directions through the sponge body (Fig. 10, Plate **5**).

The wall of the stalk is largely occupied by diacts, which run for the most part longitudinally. In the upper part of the stalk these spicules are free. Elsewhere they are connected by abundant synapticula, a continuous framework thus being produced. Scattered diacts protrude radially from the surface of the stalk to a distance of from 1 to 5 mm. The diacts as a class are similar to those of the body, but longer and thicker, many reaching a size 7–8 mm. x 24–32 μ. The extremities may be entirely covered with sharp microtubercles, or the tuberculation may be subterminal. In the lowest part of the stalk some diacts are met with which have smooth, pointed extremities.

The dermal and gastral pinules (Figs. 7 and 10, Plate **4**) are much alike. They are both hexacts in which the proximal and tangential rays are about equal in length and thickness. These rays are pointed and tapering, with very small, sharp microtubercles near the end, elsewhere smooth or with only a few scattered tubercles; about 100 μ x 8–10 μ. In both pinules the distal ray is covered with overlapping upwardly projecting narrow scales, which have a greatest length of 16–20 μ. Near the base the scales degenerate into small prickles, projecting at about right angles to the axis of the ray, and at the extreme base the ray is smooth. The ray ends above in a terminal cone, not in a long point. This in the slenderer spicules is commonly longer than wide, but in the stouter ones is as wide as long and is nearly concealed by the uppermost scales, its tip not infrequently being rounded instead of pointed.

Except in two specimens the dermal and gastral pinules differ slightly as regards the length and thickness, and consequently the outline, of the distal ray. In the two specimens referred to, measurements failed to show a constant difference between the pinuli of the two surfaces. In the other specimens the dermal pinuli have distal rays which are slightly shorter and thicker than those of the gastral pinuli. *Measurements show that this relative difference between dermal and gastral pinuli exists, although in some specimens both kinds of pinuli are perceptibly stouter than in others.* Thus in a number of specimens the gastral pinuli were like the one shown in Fig. 10, Plate **4**, where the distal ray is so slightly swollen in the middle as to be almost cylindrical in outline. In the same specimens the dermal pinuli were like the one shown in Fig. 7, Plate **4**, where the distal ray is sufficiently swollen in the middle for the outline to be distinctly fusiform. In other specimens the *gastral* pinuli were quite as stout and fusiform as Fig. 7, Plate **4**, and the *dermal* pinuli still somewhat stouter and more fusiform. Thus while the individual sponges differ among themselves, within narrow limits, to be sure, in respect to the precise shape of the distal ray, the relative difference between the two surfaces is usually maintained. This generalization is illustrated by the following tabular statement, showing the common range of variation among the spicules of two individuals, the one with pinuli as slender as in any of the specimens, and the other with pinuli as thick as in any of the specimens.

	Distal Ray of Dermal Pinule.		Distal Ray of Gastral Pinule.	
	Length.	Greatest Thickness.	Length.	Greatest Thickness.
1. Sponge with slender pinules,	240–320 μ	36–40 μ	260–360 μ	32–36 μ
2. Sponge with stout pinules,	210–240 μ	44–56 μ	280–320 μ	36–40 μ

On both surfaces the following uncommon types of pinuli make their appearance. In one type, Fig. 8, Plate **4**, the distal ray is conspicuously shortened but not very swollen. Much less frequent is the type shown in Fig. 1, Plate **4**, in which the distal ray is very short and greatly swollen. The latter spicule is similar to the dermal pinuli of *C. latus* F. E. Sch. and *C. elegans* F. E. Sch.

The general dermal covering of the stalk is in all cases lost, but in one of the specimens some of the pinules on the upper part are preserved. These are smaller than the pinules of the body, the proximal and tangential rays measuring about 80 μ x 6–8 μ, the distal ray about 200 μ x 24 μ. The covering spines on the distal ray are not so closely set as in the pinules of the body.

The hypodermal and hypogastral pentacts (Fig. 9, Plate **4**) are alike. All the rays taper to rounded points, and there is no trace of the distal ray. The proximal ray is ordinarily longer than the tangentials, but occasionally is very short, especially in the case of pentacts lying over the main canals. The proximal ray is roughened with sharp microtubercles in its upper part. The tangential rays commonly show a few sharp microtubercles near the point of intersection, but may be smooth, or on the other hand extensively covered with microtubercles in this region. The tangential rays are straight or very slightly incurved; exceptionally somewhat outcurved. The spicules vary in size in the same individual, the tangential rays measuring 400–750 μ x 36–48 μ, the proximal ray measuring commonly 780–1000 μ x 50–60 μ.

The tangential rays of the pentacts overlap and give rise to a meshwork, the meshes of which are very commonly square or squarish. The size of the mesh varies considerably in different regions of the same individual as well as in different individuals; diameter commonly 340–680 μ. Where the pentacts are crowded, some lie at a slightly lower level than others, and so interfere with the regularity of the meshwork.

On the upper part of the stalk a few of the hypodermal pentacts remain. Some are like those of the body; others differ in that they are quite smooth.

The spinose microsclere (Figs. 1, 4, 5, 9, Plate 5) found in all the species of the genus is here present in the greatest abundance, everywhere filling the parenchyma. While the true discohexact, in which none of the rays are branched, occurs in all of the specimens, and in a few is the predominant form, it is in most of the specimens uncommon. The rays of the discohexact are 80–110 μ x 8 μ, tapering strongly toward the apex, which is capped by a watchglass-shaped end-plate, 10–12 μ in diameter, divided marginally into about 6 strong teeth. The rays except near the centre of the spicule bear strong recurving spines, which diminish in size toward the apex of the ray.

In most of the specimens the great majority of these spicules are imperfect hexasters (Figs. 1 and 4, Plate 5). Spicules in which 3 or 4 of the original hexact rays are branched, while the others remain single, are the commonest types, although perfect hexasters, in which all 6 original rays are branched, occur. In the hexasters, imperfect or perfect, the principal rays are smooth and short, and the combined length of principal and terminal equals the length of the undivided hexact ray. The terminals are spinose and capped, as in the true hexact forms. The principals may bear 2 or 3 terminals, but 2 is the commoner number. Exceptionally, as in one of the rays of Fig. 9, Plate 5, there is no proper principal, the branching occurring so close to the centrum of the spicule that the terminals are confluent with it.

A detail of some interest as bearing on the mode of development of the hexaster form is indicated in Figs. 1 and 4, Plate 5. In spicules where the principal ray bears but two terminals, the latter commonly pass into the principal in an asymmetrical fashion. One of the terminals makes a bend at its lower end, thus becoming strongly convex on this part of its outer surface, while the corresponding surface of the other terminal and the adjoining part of the principal form a weakly concave surface. This fact, together with the angles which the several rays make with one another, often suggests that certain rays represent the primitive hexact rays and that *other terminals are produced as lateral branches* on these. Much less commonly the two terminals are symmetrically disposed on the principal, suggesting an early dichotomy, but in such cases the symmetry may have been superinduced on an earlier asymmetry. Where the principal bears 3 terminals, the arrangement is usually symmetrical and gives no hint as to whether the branching had been lateral or not. But exceptional spicules, like that shown in Fig. 5, Plate 5, occur which speak for the lateral origin of the branches, in that two terminals occupy a lateral position on the same side of what seems to be a primitive hexact ray.—— Very frequently, perhaps always, the opposite rays of a diameter branch in planes at right angles to one another, as shown in Fig. 4, Plate 5,— a phenomenon observed by Schulze in the hexasters of several species (1887, p. 31).

A form of discohexaster, Fig. 5, Plate 4, very similar to the corresponding spicule of *C. latus* F. E. Sch. (Schulze, 1887, Plate XXIV.) and *C. agassizii* F. E. Sch. (Schulze, 1899, Plate VI.) occurs with about the same distribution as in the latter species (Schulze, 1899, p. 38). It is most abundant near the gastral membrane and in the walls of the large efferent canals, less abundant near the dermal membrane and in the walls of the main afferent canals. In this spicule, the principals are smooth, and taper very slightly toward the apex, where they enlarge to form a base for the terminals. These commonly vary in number from 5 to 10, and are arranged in a whorl. Not infrequently, however, spicules are found with more numerous terminals, up to 16, which do not form a whorl but a brush, some being surrounded by others, Fig. 6, Plate 5. The terminals are roughened and very slender, and taper toward the apex, where they bear small end-plates of a watchglass shape. In the larger spicules the end-plate is obviously divided into marginal teeth, and the ray in its distal half is not merely roughened but bears small recurving spines. The size of the spicule varies considerably in the same specimen. The terminals as a rule considerably exceed the principals in length, being from 1.5 to 2.5 the length of the latter. The principal measures 36–50 μ x 6 μ, the terminal 60–100 μ x 2 μ.

Occasionally this discohexaster exhibits an abnormality of some interest. One or several of the principal rays, in addition to bearing terminal umbels, bear one or in some cases two lateral branches, one above the other, Fig. 2, Plate 5. Such lateral branches resemble the terminal rays. Moreover, examination of the larger discohexasters shows that the base of the umbel is frequently asymmetrical. An extreme case of this kind is shown in Fig. 8, Plate 5. These appearances receive an explanation on the hypothesis that the umbel of terminals represents an aggregation of lateral branches, and that during the growth of the spicule some of the lateral branches may become separated from the main cluster.

A good many small discohexasters occur, having a similar distribution to the large form just described. Some of these are doubtless stages in the development of the latter type, although the principal ray is often about equal in length to the terminals, as in Fig. 3, Plate 5. The principal may bear one or two lateral rays. In a selected spicule of this character the principal rays and the terminals are both 40 μ long; in another such spicule the principal is 26 μ, the terminals 28 μ long. Together with these spicules occur discohexasters of a different type, one of which is shown in Fig. 6, Plate 4. The principals and terminals in this spicule are commonly subequal in length, 16 to 24 μ long, but not infrequently the principal is perceptibly longer than the terminals. The brush-like clusters are relatively wide and include numerous, from 20 to 30, terminals. The principals are smooth, or bear one or two comparatively large tubercles, or sometimes a lateral ray. It is possible that this spicule is of foreign origin. But against this supposition speaks its distribution, as does also the fact that other small discohexasters occur, which are intermediate in structure between the types shown in Fig. 3, Plate 5, and Fig. 6, Plate 4. As an example of such intermediate forms I select a spicule in which the principal rays are 24 μ long; terminal rays 20 μ long; terminals 10–15 in a cluster; clusters intermediate in relative width between Fig. 3, Plate **5**, and Fig. 6, Plate **4**.

Caulophacus, sp.

Plate 5, Fig. 7.

At Station *3414*, the lower part of a stalk belonging to a species of *Caulophacus*, apparently not *C. schulzei*, was taken. The stalk (Fig. 7, Plate **5**), which is attached to the root spicules of *Hyalonema*, is firm, hard, and of a dark-brown color. The length of the fragment is 40 mm., the diameter of the upper broken end 4 mm. The axial cavity is very small, about 0.75 mm. in diameter. The base is an irregular mass elongated in the direction of the *Hyalonema* spicules, round which it has grown. Some of the *Hyalonema* spicules remain *in situ*, while others have been pulled out, leaving their impressions upon the *Caulophacus* base.

The dermal covering has been lost. Whether the few pinules and large pentacts adhering to the surface belong to the specimen is questionable. The diacts forming the chief support are arranged for the most part longitudinally, and are connected by synapticula. Scattered diacts protrude more or less radially from the surface to a distance of from 1 to 4 mm. The diacts taper slightly from the middle toward the ends, frequently exhibit an annular thickening in the middle, which is very slight in the large forms, but conspicuous in some of the smaller, and end in smooth pointed extremities. The diameter of the larger spicules is 24–30 μ, the length reaching at any rate 4 mm.

At the same station, two other *Caulophacus* stalks of a somewhat different appearance were dredged. Only the diact skeleton remains. One of the stalks is remarkable for its thickness, having a diameter at one end of 13 mm., the axial cavity being about 2 mm. wide and filled with mud.

ROSSELLIDAE F. E. Schulze.

Bathydorus F. E. Schulze.

1887. *Bathydorus* F. E. Schulze, 1887, p. 150.
1897. " F. E. Sch., Schulze, 1897, p. 14.
1898. " F. E. Sch., Ijima, 1898, p. 46.

Bathydorus levis F. E. Schulze.

1895. *Bathydorus laevis* F. E. Schulze, 1895, p. 57, Taf. VI. Figs. 1–10.
1902. *Bathydorus levis* " 1902, p. 78, Plate XIV. Figs. 1–10.

Bathydorus levis spinosus, subsp. nov.

Plate 5, Figs. 11-13; Plate 6, Figs. 1, 2.

Diagnosis. Body calyculate. Both dermal and gastral surfaces with scattered prostalia. Autodermal stauracts densely covered with sharp spines 1–2 μ high. Distal ray of autogastral hexact longer, and with longer spines, than the other rays. Oxyhexasters 80–100 μ in diameter.

Station 3382, 2 specimens; *Station 3399*, 1 specimen and a fragment.

Of the specimens taken at Station 3382, one is a thin, laterally compressed sac, Fig. 11, Plate **5**, with a greatest horizontal diameter of 46 mm. and a depth of 25 mm. The wall is about 1 mm. thick, thinning toward the edge. The extreme lateral compression is doubtless unnatural. There is a marked concavity on one side of the sac, and the base of the sponge is somewhat pointed, projecting toward the concave side. The dermal surface of the basal portion is indented by an oblique furrow about 2 mm. wide and 6 mm. long, probably caused by the cylindrical body (*Hyalonema* root spicule ?) to which the sponge was attached.

The second specimen from Station 3382, Fig. 1, Plate **6**, is much broken, but fortunately the base is preserved intact. As in the other individual, the sac is pointed below and concave on one side. Nearly the whole of one lateral wall of the sac has been torn off. The opposite lateral wall is about 60 mm. wide and 2 mm. thick, thinning toward the free edge, only a part of which is natural.

The sac in the concave region to one side of the pointed base tightly grasps what is probably a *Caulophacus* stalk. The stalk in question is a fragment 30 mm. long and about 4 mm. thick. It is roughly cylindrical, hollow, and slightly curved. Only the skeletal framework remains, which consists of diacts, running for the most part longitudinally, and richly connected by synapticula.

The specimen from Station 3399 has the shape of a wide, shallow cup and is not laterally compressed. The cup, in which both base and edge are preserved, is 53–63 mm. wide and about 20 mm. deep; the wall 3 mm. thick near the centre and thinning out toward the edge. In the centre of the cup the wall is steeper than elsewhere, and thus an inner basin is marked off from a more peripheral region. The peripheral part of the wall flattens out somewhat, tending toward the horizontal plane, and in one region is recurved much as in Schulze's figure of *B. levis* (Schulze, 1902, Plate XIV. Fig. 1). The inner surface of the cup, in the peripheral region, is undulating, and the edge likewise undulating, as in Schulze's figure. Viewed from the under surface, the base of the cup forms a well-marked protuberance, to one side of which the sponge tissue has grown round three *Hyalonema* root spicules, remnants of which remain half buried in the wall. The fragments of root spicules lie close together, parallel to one another and about parallel to the horizontal axis of the cup. They are doubtless part of a *Hyalonema* root tuft to which the *Bathydorus* was attached.

The fragment dredged at Station 3399 is a plate-like piece 30 mm x. 25 mm. and about 2 mm. thick, including a part of the natural edge of the sponge, 40 mm. long.

In all the specimens both dermal and gastral surfaces exhibit fairly abundant although scattered prostalia, projecting obliquely or radially to a distance of from a few to 10 mm. The spicules are chiefly smooth diacts, but in part large smooth hexacts with unequal rays, only one ray of which projects. The rays of a single hexact may vary in length from 2 to 10 mm., the protruding ray being long. In addition both surfaces are abundantly covered with the ends of slender diacts projecting 1–2 mm.

Round the edge, numerous diacts project 1–2 mm., and scattered diacts protrude through all distances up to about 5 mm. These scattered spicules are pretty far, 5–10 mm., apart. The spicules project at all angles from the edge, and nowhere constitute anything so definite as a fringe.

On both surfaces of the sponge, the rounded apertures of small canals are abundant and plainly visible. The diameter of the canals is in general less than, although reaching, 1 mm.

The autodermal stauracts, Fig. 13, Plate 5, are abundant, the rays overlapping so as to form a meshwork. The rays are cylindrical, or taper very slightly toward the apex, there becoming suddenly rounded or pointed, and are densely covered with short, sharp spines. Basal diameter of the ray excluding the spines, which are 1–2 μ high, is about 5 μ. The rays are equal or subequal in length; total diameter of the spicule, 100–160 μ. A direct comparison with preparations of *B. levis* shows that in the latter species the stauracts are much less strongly spinose than in the form here described.

In the autogastral hexacts, Fig. 2, Plate 6, the rays are straight or slightly curving, the distal ray commonly more distinctly curved than the others. The tangential and proximal rays bear very small, sharp spines. The distal ray, which is longer than the others, bears longer spines, many of which project upwards. The tangential and proximal rays taper evenly to points; the distal ray is cylindrical, then tapering. All rays have a basal diameter of about 4 μ. Length of the distal ray, 110–140 μ; length of the proximal and tangential rays, which are subequal, 60–90 μ.

Schulze (1902, p. 80) mentions that in *B. levis* the spines on the distal ray of the autogastral hexact are often slightly different from those on the other rays. On the other hand, in the form here described, spicules occasionally occur in which the 6 rays are equally long.

The oxyhexasters, Fig. 12, Plate 5, are 80–100 μ in diameter. The smooth principals are 4–6 μ long. The delicate, roughened terminals, of which there are 2 or 3 to a principal, diverge strongly, are slightly curved, and taper evenly to points.

In the hypodermal pentacts all rays are smooth, tapering to points which are not very sharp; no trace of the distal ray. The proximal ray, which passes more than halfway through, often nearly through, the sponge wall, is 1.0–1.7 mm. x 30 μ; frequently accompanied by 2 or 3 diacts. The paratangential rays are 340–500 μ x 24 μ, overlapping and forming a meshwork, with meshes 340–500 μ in diameter.

The ends of the diacts are pointed, or rounded and often enlarged; roughened with microtubercles, which may cover the entire end or be restricted to a subterminal area. The slender diacts are commonly pointed and not enlarged at the ends, and are nearly cylindrical. The larger diacts obviously taper from the middle toward the ends. The diacts vary in length from 1 to 15 mm., in thickness from 7 to 60 μ. While most of them lie parallel to the sponge surfaces, numerous slender ones and the scattered large prostalia pass obliquely or radially through the wall. As in *B. levis*, the largest diacts are in the neighborhood of the gastral surface, where they frequently form tracts.

In addition to the large smooth hexacts already mentioned, one ray of which protrudes as a prostal spicule, smaller hexacts are occasionally found with equal or unequal rays, reaching 700 μ in length, spinose, and sometimes curved. It may be questioned whether they belong to the sponge.

Schulze's specimens of the type were taken in the southwestern part of the Bay of Bengal on Globigerina ooze, at a depth of 1997 fathoms. It is very easy for scattered prostalia to be lost in the handling of a sponge, and as Professor Schulze has suggested, perhaps such spicules were originally present in his specimens.

Staurocalyptus Ijima.

1887. *Rhabdocalyptus* F. E. Schulze, *pars*, Schulze, 1887, p. 155.
1897. " " " , Schulze, 1897, p. 33.
1897. *Staurocalyptus* Ijima, 1897, p. 53.
1898. " Ijima, 1898, p. 52.
1899. *Staurocalyptus* Ijima, Schulze, 1899, p. 47.

Staurocalyptus, sp.

Plate 6, Figs. 4-10.

At *Station 3370*, a small sponge was taken, which is completely macerated, but in which the shape has been preserved, owing to the fact that the parenchymal diacts are so interwoven with one another. There are no discoverable autodermal or autogastral spicules distinguishable from the parenchymalia, and the probability is that they have been completely lost. The specimen differs from the described species of the genus, but may turn out to be a young form. Owing to the absence of the autodermalia and autogastralia, the sponge cannot be adequately characterized, and I refrain from giving it a specific name.

The body, Fig. 6, Plate **6**, is a flattened sac 25 mm. high with a greatest transverse diameter of 15 mm.; wall about 4 mm. thick, gradually thinning out above to an oscular edge. Long prostal oxydiacts protrude from the upper end of the body, forming a collar. These spicules extend longitudinally through the lateral wall of the body, emerging above, at some distance below the oscular margin, which is thus left free of projecting spicules, as in *Aphorme horrida* F. E. Sch. (Schulze, 1899, p. 41).

The prostalia are the large oxydiacts just referred to and pentacts, which properly are hypodermal, but which may protrude. The oxydiacts measure 2 cm. x 150 μ to 3.5 cm. x 225 μ, are slightly curved, smooth, tapering evenly toward each end. The smaller ones run out to very fine points. In the larger ones the extreme ends are broken off.

The prostal and hypodermal pentacts have paratropal, paratangential rays, Fig. 5, Plate 6. The shaft is 6 mm. or more in length, 100 μ thick at the upper end, tapers evenly to a point, and is very faintly tuberculate, appearing smooth. The paratangential rays measure 2.5 mm. x 75 μ to 3.75 mm. x 85 μ, and are nearly straight or slightly curved; tapering evenly to points; minutely tuberculate. Small forms of the same spicule occur, with paratangential rays as short as 550 μ. —— The tubercles on the paratangential rays are fine, closely set prickles, which in general project toward the apex of the ray, Fig. 7, Plate 6. They diminish in number toward the proximal end of the ray, and here may be nearly or quite absent (Fig. 5, Plate 6). In some spicules the tubercles are so fine that the whole ray appears nearly smooth. The tubercles are outgrowths of the superficial silicious layer, which is frequently cracked, and may peel off, leaving the ray smooth.

The parenchymal macroscleres are chiefly long slender diacts, more or less curved, extending in all directions through the body; many running parallel to the surface; others more or less radially to the surface and protruding slightly. Length extremely various, 4 mm. to about 1 cm.; diameter, 8–24 μ. The two ends of a spicule are unlike: one end sharp-pointed; the other end blunt-pointed, or rounded without enlargement, or dilated. Both ends are minutely spinose, the shaft smooth. Smaller oxydiacts, about 0.5 mm. x 8 μ, are also common in the parenchyma; with median enlargement and axial cross; both ends running out to fine points; feebly spinose along the whole length.

In the parenchyma the following additional macroscleres occur rarely: hexacts, with rays about 0.5 mm. x 30 μ, smooth, tapering evenly to points; tauactines and stauractines, rays smooth, tapering evenly to points, about 250 μ x 8 μ. —— There are no discoverable hypogastralia.

Discoctasters are abundant in the parenchyma. Many conform to the type, having 8 principal rays, each of which bears usually 3 slender terminals; terminals minutely enlarged at the end; centrum with a rounded protuberance in the centre of each set of 4 rays. The principal ray is about 45 μ long; terminals about 60 μ long; centrum with a diameter of 20 μ.

That the octaster rays are secondarily produced, as Schulze (1893) has demonstrated, by the fusion of components, which themselves are derived from the rays of an original hexact, is well shown both in the typical and "abnormal" spicules of this species. The various facts described by Schulze (*l. c.*), such as the trilobed transverse section of the octaster rays, the ridges passing from the central protuberances out upon the rays, and the delicate row of lacunae, extending lengthwise through the latter, may all be observed in the typical spicules. The axial cross is plainly visible in the centrum, as Ijima (1897, p. 44) pointed out. It frequently happens that, as in some of the species described by Schulze, *e. g. Rhabdocalyptus mirabilis* (Schulze, 1899, Taf. XIII.), one or several accessory rays which end like the terminals are developed as outgrowths from the central protuberances (Fig. 8, Plate 6). It also happens not infrequently that the fusion of the originally separate components is very incomplete, in which case the octaster ray appears split to its very base, as in one of the rays of Fig. 10, Plate 6. In some cases there is almost no fusion, as in some of the rays of Fig. 4, Plate 6. Where the fusion is imperfect, and in addition several of the protuberances on the centrum are directly prolonged into rays, a very irregular spicule is the outcome, in which the octaster character is not conspicuous (Fig. 4, Plate 6). Irregular spicules of this kind are referred to by Schulze in several places (1887, p. 157; 1893, p. 6).

Oxyhexasters are abundant in the parenchyma. The principal rays are smooth, cylindrical, about 3 μ long. There are two terminals to each principal, nearly straight, strongly diverging, slender, and tapering evenly to the point, about 35 μ long. Oxyhexasters are common in which on one or more of the principal rays only one terminal is present. The remaining terminal and the principal ray may or may not make an angle with each other. In the latter case the division point between principal and terminal is not recognizable. When all six rays are of this character, a small hexact is produced such as has been designated by Ijima (1897, p. 45) a *hexactin-shaped oxyhexaster*. —— Microdiscohexasters were carefully looked for, but none were found.

FARREIDAE F. E. Schulze.

Farrea Bowerbank.

1864. *Farrea* Bowerbank, 1864, p. 204.
1887. *Farrea* Bwk., Schulze, 1887, p. 266.
1899. " " " 1899, pp. 106–109.

Farrea occa (Bowerbank) Carter.

1864. *Farrea occa* Bowerbank, 1864, p. 204.
1885. *Farrea occa* Bwk., Carter, 1885, p. 387.
1887. *Farrea occa* (Bowerbank) Carter, Schulze, 1887, p. 277.
1895. " " " " p. 67.
1899. " " " " p. 68.

Farrea occa claviformis, subsp. nov.

Plate 6, Figs. 3, 11-14; Plate 7, Figs. 1-3, 6.

Diagnosis. Habitus like that of the type. With oxyhexasters. Characteristic dermal clavulae, with smooth ovoidal heads. Characteristic gastral clavulae umbellate, with few (6–9) teeth.

Station 3425. Two fragmentary specimens.

The habitus, Fig. 3, Plate 6, is like that of the type, but the projecting ends flare more. The tube diameter is 10–14 mm. The dictyonal framework is single-layered, and the radial tuberculate processes vertical, or nearly so, to the framework.

The specimens show some vaguely marked elevations, which are probably comparable to the tubular ridges described in this report for *Eurete erectum,* and interpreted as having been produced during the growth and division of the cup-like apertures.

In spite of the individual variation among the spicules, it may be seen that the dermal pentacts (Fig. 2, Plate 7) are somewhat smoother than the gastral (Fig. 6, Plate 7). Otherwise the two classes are alike. The five rays are of about the same size, and a rudiment of the distal ray ordinarily persists as a tubercle, which is pointed in some spicules, rounded in others. The precise degree and character of the curvature of the tangential rays, and of the tuberculation, and the shape of the ends of the tangential rays, vary slightly. On the outer surface of the tangential rays the tubercles are well developed, elsewhere nearly absent, except at the end of the ray. A common size of ray measures 280 μ x 12 μ. The spicules closely resemble those described by Schulze for the "Challenger" specimens of *F. occa*, differing in some details from the pentacts present in the specimen of *F. occa* which Schulze had from the Bay of Bengal (1895, p. 67).

The uncinates, Fig. 11, Plate 6, commonly show a difference between the two ends. At the external end, as over the middle part of the shaft, the spines are pretty long and nearly parallel to the shaft. Toward the inner (gastral) end they become minute sharp denticulations. The length of the spines varies considerably on different uncinates, and they may degenerate all over the spicule into denticulations. The uncinates may even become smooth, in which case I have found them to be slenderer than the common forms. A common size is about 600 μ long by 5 μ thick, excluding the spines. But spicules up to twice this size occur.

Oxyhexasters are abundant, and similar to those of the type (Schulze, 1887, Plate LXXI. Fig. 7). The principal ray is 20–24 μ long, and bears 3, 4, or 5 terminals, which are about half as long as the principal. Oxyhexasters occur here and there which differ from the common form in that the terminals are as long, or nearly as long, as the principals. Such spicules are somewhat larger than the common form, and usually there are only two or three terminals to a principal.

The dermal clavulae, Fig. 2, Plate 7, with rare exceptions, have smooth ovoidal heads, and are about 300 μ long. The stalk is slender and smooth, except near the point, where it is roughened. The spicules occur in the usual position, in groups surrounding the proximal rays of the pentacts. The number in a group is inconstant, always small (3–5); but some spicules may have fallen out. The exceptional dermal clavulae, which are very rare, are like the form common on the gastral surface.

In the type (Schulze, 1887, p. 283) the shape of the upper end of the dermal clavula varies from a many-toothed umbel, or a tuberculated swelling, to a smooth club. The first-mentioned shape is the predominant form.

The gastral clavulae are arranged, like the dermal, in small groups of 3 to 5, round the proximal rays of the corresponding pentacts (Fig. 6, Plate 7). The common form, Figs. 12, 13, 14, Plate 6, has an umbel with 6–9 teeth, which overarches a smooth swelling. Umbels with as many as 16 teeth occur, and occasionally a spicule is found in which the swelling is minutely tuberculate. In the latter cases observed the umbel had 14–16 teeth. The stalk is like that of the dermal clavula, but is shorter, — common length about 240 μ. Spicules are quite frequently found in which the umbel is degenerate, the teeth remaining as minute structures, Fig. 1, a, b, c, Plate **7**. Sometimes the merest rudiments of the teeth, so small that they are apt to escape notice, remain on the otherwise smooth head, and very occasionally a clavula with a perfectly smooth head is found. In certain cases all the teeth degenerate except one, which is fairly well developed.

A very few gastral clavulae of the type shown in Fig. 3, Plate **7**, were found. The umbel teeth are long and with a distinct spiral twist. The stalk is much longer than in the common gastral clavulae, and is slightly curved. In the spicule figured, the stalk bore a lateral spine which was absent in the others found. Only half a dozen of these spicules were found in as many preparations, and they would naturally be looked upon as foreign, were it not that they occupy the same position with respect to the pentacts as do the other clavulae. This spicule is closely similar to the peculiar clavula of *Farrea convolvulus* F. E. Sch. (Schulze, 1899, Plate XVI.), the stalk of which bears 3 to 5 lateral spines. Its very occasional occurrence here has the greater interest for the existence of a species in which the characteristic spicule is so closely similar.

In the type (Schulze, 1887), the predominant form of gastral clavula has a smooth anchor-like head with 4–8 long teeth. But forms having a terminal umbel with numerous teeth, which overarches a swelling, occur and may predominate.

Farrea clavigera F. E. Sch. (1887, p. 287, Plate LXXV.) resembles the subspecies here described in having smooth club-shaped dermal clavulae, but differs from it in habitus, in having anchor-like gastral clavulae, and in having a second peculiar form of dermal clavula.

Farrea occa is a widely distributed species. *F. convolvulus* F. E. Sch. was taken 32° 49′ N., 117° 27′ 30″ W., at a depth of 656 m.

Farrea mexicana, sp. nov.

Plate 7, Figs. 4, 5, 7, 8, 10, 11.

Diagnosis. Habitus like that of *Farrea occa.* With oxyhexasters. Characteristic dermal clavulae umbellate, with 12–16 teeth in the umbel. Gastral clavulae in part umbellate like the dermal; in part anchor-like with 4–5 teeth, the stalk usually with 2 lateral spines. Species close to *F. aculeata* F. E. Sch.

Station 3430, 1 fragmentary specimen.

The habitus, Fig. 7, Plate **7**, is similar to that of *Farrea occa.* The tube diameter is 8 mm. The dictyonal framework does not differ from that of *F. occa.* In places it is one-layered, in other places two-layered. Small oxyhexacts with rays 60–80 μ long are in places fused with the framework. The fragment is obviously from the older part of a stock.

The dermal and gastral pentacts are alike (Fig. 8, Plate **7**). The proximal ray is slightly longer than the tangentials, which commonly measure about 280 μ x 12 μ. The rudimentary distal ray forms a small rounded tubercle. In the majority of the spicules, the rays are smooth except at the ends. In others the tangential rays bear very weak tubercles over their whole surface. Occasionally spicules are found, in which the tangential rays on their outer surface bear the well-known strong spinous tubercles.

The uncinates commonly exhibit the same difference between the two ends which I have mentioned under *Farrea occa claviformis.* The spicules vary greatly in size. Forms, 720 μ x 5 μ, and larger ones up to twice this size, occur.

The oxyhexasters resemble those of *F. occa,* but are larger; and the terminal rays, of which there are usually 2 or 3 to a principal, are as long or nearly as long as the principal. The length of the latter is about 40 μ. There is occasionally a surprising difference in length between the principals of the same spicule.

In *Farrea aculeata* F. E. Sch., Schulze (1899, p. 70) says the oxyhexasters do not essentially differ from those of *F. occa.* He mentions that the number of terminals to a principal is 3, 2, or 1; and in the spicule figured, the principal ray measures 35 μ in length, while the terminals are about as long. Thus in the minute points of difference which the oxyhexasters of *F. mexicana* exhibit toward those of *F. occa*, there seems to be an agreement between it and *F. aculeata*.

The dermal clavulae are with few exceptions umbellate forms (Fig. 8, Plate 7), having commonly 12 to 16 teeth in the umbel, occasionally less than 12 or more than 16. The stalk including the enlarged upper end is smooth except near the point, where it is roughened. The length of the spicule is about 320 μ.

On the dermal surface are found a very few of the anchor-like clavulae which are common on the gastral surface. Both kinds of dermal clavulae are in place, in the usual position round a pentact, the number actually present in a group being small, 3–6.

The gastral clavulae are in part umbellate, in part anchor-like forms. The former, which perhaps are the more abundant, do not differ from the type which is found on the dermal surface. The anchor-like forms occur in the usual position with respect to the pentacts. Frequently such a spicule is found alone, sometimes together with a few of the umbellate spicules. Where the spicule is alone, it is of course probable that the other members of the group have fallen out. In this spicule (Figs. 4, 5, 10, 11, Plate 7), the stalk is about 500 μ long, smooth, practically straight, or slightly or strongly curved, becoming very slender and ending below in a point. It terminates above in a rounded knob, below which there is no conspicuous bulb-like swelling. The knob bears 4 or 5 curved strong teeth, which in some spicules, but not in all, have a slight spiral curvature (Fig. 11, Plate 7). A short distance below the head, the stalk bears usually two curved lateral spines, sometimes only one, and occasionally none. The curvature of the spines themselves varies, sometimes being simple, again feebly spiral, while rarely the spines are straight. While the head ordinarily bears 4 or 5 teeth, spicules are occasionally observed with but 3 teeth (Fig. 5, Plate 7). As regards length of the teeth and width of the umbel (anchor), the anchor-shaped spicule varies considerably. While always larger than the many-toothed umbellate spicule, it is sometimes only about twice as wide, and again fully four times as wide as the latter, across the umbel. The actual length of the teeth varied, in the numerous spicules measured, from 24 μ to 48 μ, and the width of the umbel (anchor) from 32 μ to 88 μ.

In the obviously closely related species *Farrea aculeata* F. E. Sch. (Schulze, 1899, p. 70), the dermal and gastral clavulae are alike, and essentially similar to the anchor-like forms above described. The number of lateral spines is 2–5, and they may be straight or curved. The teeth of the anchor never show a spiral curvature, as they do in some of the spicules of *F. mexicana.* Similar anchor-like clavulae with lateral spines are described by Topsent (1901, p. 466) for *Farrea weltneri* Tops., in which the hexaster is a discohexaster.

Farrea aculeata F. E. Sch. was taken 47° 29′ N., 125° 33′ 30″ W., at a depth of 1163 m.

Farrea, sp.

At *Station 3425,* 8 specimens, and at *Station 3430,* 2 specimens, of *Farrea* were taken. In these only the dictyonal framework is preserved, and a closer identification is therefore impossible.

Schulze (1887, p. 278) mentions that in *F. occa* he has occasionally found the terminal openings of the tubes covered in with porous plates. In one of the specimens here recorded, I find that two of the openings are nearly closed in by such reticula. In each case a small aperture, which is rounded and apparently natural, has been left near the edge of the original opening.

EURETIDAE F. E. Schulze.

Eurete Semper.

1868. *Eurete* Semper, 1868.
1887. *Eurete* (Semper) Carter, Schulze, 1887, p. 289.
1899. *Eurete* Semper, Schulze, 1899, pp. 106–109.

Eurete erectum F. E. Schulze.

1899. *Eurete erectum* Schulze, 1899, p. 72, Taf. XVII. Figs. 1–3.

At *Stations 3358, 3359,* and *3380,* 19 specimens were taken referable to this species. While they were all partially macerated, the free spicules had been retained. These specimens differ from the type and from one another in details, and fall into three well-marked groups which I designate as subspecies. The specimens from Station 3380 constitute one of these groups. Each of the other two groups includes specimens from both of the other two stations.

A dozen completely macerated specimens, agreeing with the above in habitus and dictyonal framework, were obtained at the above stations and at Station 3370. These probably also belong to *Eurete erectum*, which is obviously an abundant species in these waters. Schulze's specimens came from the same general locality. They were taken in the neighborhood of the Galapagos Islands, 0° 24′ S., 89° 06′ W., at a depth of 717 m. on a sandy bottom.

Eurete erectum tubuliferum, subsp. nov.

Plate 7, Figs. 9, 12; Plate 8, Figs. 1-3, 6.

Diagnosis. Sponge body differs from that of the type in that the axis is not dichotomously prolonged into branches at its upper end. Dermal pinules, gastral hexacts, and gastral pentacts resemble those of the type. With onychasters. Characteristic dermal scopulae are small forms with 3–4 distal rays, which are denticulate and which terminate in small smooth heads. The gastral scopulae resemble those of the type, but the distal rays are not covered with recurving spines, but are either smooth or minutely denticulate.

Station 3358, 3 specimens; *Station 3359,* 7 specimens.

As in the type there is a basal plate from which the slender hollow axis arises, but the plate is not included in all of the specimens. The axis, which at first is only about 7 mm. wide, gradually enlarges, becoming about 15 mm. wide, and soon acquires the spiral curvature characteristic of the species (Fig. 1, Plate **8**). In several of the specimens the upper end of the sponge is preserved, and it may be seen that the axis is not dichotomously prolonged into branches, as in the type, but remains single.

The degree of development of the lateral branches varies considerably. They may appear as simple cups with a slightly or considerably flaring wall. This is especially the case on the lower part of the stem, and all of the branches have this character on some of the fragments, which yet are large. The cup wall is often broken off short.

Very commonly, however, the branches are incompletely or completely divided, but not more than once. Various stages in the division are present. The opposite parts of the cup edge may simply project toward one another, as in Schulze's figures of *Farrea* (1887, Plate LXXII. Fig. 3). Or the growth may have continued until the opposite lips of the original cup are apposed, as in Fig. 12, Plate **7**, which represents in apical view the upper end of the specimen shown in Fig. 1, Plate **8**. With continued growth the apposed edges coalesce, and we then have a branch which opens to the exterior by two separate and distinct apertures. The shape of such branches is tubular with an aperture at each end. The character of the branches is well shown in Fig. 1, Plate **8**, and in Fig. 9, Plate **7**, which represents a detail of the opposite side of the sponge shown in Fig. 1, Plate **8**.

A comparison of different branches shows that before the lips of the original cup fuse, they become folded outward so as to present toward each other parallel faces (Fig. 12, Plate **7**). Fusion then takes place between these folds along their outer edges, and later, often imperfectly, along their inner edges. In this way hollow ridges or tubular structures open at the opposite ends, and at first communicating with the cavity of the branch, are formed. Such structures, once formed, indicate the line along which the cup lips have concresced (Fig. 9, Plate **7**). The fusion between the outer lips of the folds may take place at first in spots, and thus for a time the cavity of the ridge or tube communicates with the exterior through slits or a series of rounded pores, as in the ridge extending between the two concrescing cups of Fig. 12, Plate **7**.

The sponge at its upper end terminates in an expanded cup, which in the different specimens shows different stages in division. The division of the terminal cup (Fig. 12, Plate **7**) takes place in the same way as that of the lateral cups: the concrescing lips become apposed along a straight line and then bend outward.

All along the sponge, extending from the lateral branches on to the axis, are tubular structures or ridges similar to those formed in the division of the cups. One such is shown in Fig. 9, Plate **7**, extending at about right angles from the tubular ridge which itself extends between the terminal apertures of the branch. On the lower part of the sponge these structures are often insignificant in size, as if in process of disappearance, but in general they are conspicuous. They extend sometimes from the *edge* of a flaring cup on to the axis, and again as in the figures they lie at a distance from the cup edges. They are arranged spirally along the axis of the sponge, their long axes coinciding with those of the turns of the sponge. Obviously these structures are relicts left at successive stages of growth by the continually dividing terminal cup. The latest-formed such structure in one specimen is shown in Fig. 12, Plate **7**. It here has the character of a two-walled ridge which extends between the two cups in process of division, and about at right angles to the lines along which the lips of these cups are concrescing. The ridge, as I interpret it, marks the line along which the lips of the terminal cup have coalesced, in what may be spoken of as the preceding stage of growth.

The arrangement of the tubular structures or ridges indicates that when the terminal cup, which is inclined obliquely to the stem (Fig. 1, Plate 8), divides, the lower half remains as a lateral cup, while the upper half, now the terminal cup, grows so as to add to the stem of the sponge. It moreover grows in the direction in which the cup lips last fused, but the next line of such fusion occurs at about a right angle to the last. The several steps in the gradual building up of the whole sponge from a cup-like young stage thus seem to be marked out by these relicts. The structures in question are indicated in Schulze's figure of this species (Schulze, 1899, Taf. XVII.). This method of continuous separation of lateral cups from the terminal with formation of a seam is probably universal in the family, and in my macerated specimens of *Eurete*, sp. traces of such seams are found. Also in some of the *Farrea* specimens, ridges are observable which correspond in position to the structures just described for *Eurete*, but they are vague and of themselves would be incomprehensible.

If *Eurete* and *Farrea* colonies are ontogenetically developed from cup-like young stages, as general considerations and the special structures above described suggest, then the small cup-like species of *Farrea* that have been described may be merely stages in the growth of larger complex colonies. Bowerbank (1875, p. 273, Plate XXXIX. Figs. 1, 4, 5) describes and figures several small cup or vase shaped *Farrea* skeletons from the West Indies. To these he gives the name of *F. pocillum*.

In this subspecies, as in Schulze's specimens, there is very little anastomosis between the lateral branches. The few instances involve a fusion between the oral lips of adjacent and bifurcated branches.

Schulze observed that in his specimens the dictyonal framework of the terminal cups for a certain distance from the edge was *Farrea*-like, consisting of but one layer of beams. In my specimens, the dictyonal framework of the terminal cups, like that of the lateral cups, includes in general two or more layers. And in parts of the extreme periphery, where the edge *seems* to be unbroken, I find two layers. I have also, however, found in the terminal cups quite small tracts, passing irregularly into the two-layered condition, in which the framework consisted of but one layer. Again in some of the lateral cups, in the stage of division corresponding to Schulze's figure of *Farrea occa* (1887, Plate LXXII., Fig. 3), I find that the rounded tongue-like outgrowths, which project toward one another, consist in part of but one layer of beams. The free edges of the lateral cups, in these dried specimens, have commonly a conspicuously thickened appearance, due to the great number of dermal pinuli which are here massed together.

In my specimens the dictyonal framework shows the usual difference between the gastral and dermal surfaces, and the radial processes on the latter surface are frequently bifid.

The dermal pinules (Fig. 3, Plate **8**) closely resemble the corresponding spicules of the type. Very commonly all six rays are about equal in length, although the proximal ray or more rarely the distal ray may be the longest. The bushy distal ray has a relatively long, bare basal portion which is cylindrical and is always slightly thicker than the corresponding parts of the other rays. The proximal and tangential rays taper evenly toward the pointed ends, where they are roughened, elsewhere smooth. The measurements of a characteristic spicule are: distal ray, 160 μ long with a greatest thickness of 36 μ, and a bare basal part 50 μ long and 10 μ thick; tangential and proximal rays, 160 μ x 8 μ. The rays may only be 100 μ long, proximals and tangentials then having a basal thickness of 6–7 μ, the distal a basal thickness of 8 μ. In some spicules the bushy distal ray, the characteristic appearance of which is given in the figure, may be thin and nearly cylindrical, bearing spines which are considerably shorter and sparser than in the typical form.

The gastralia, Figs. 2 and 6, Plate **8**, include both pentact and hexact forms. The former in most of the specimens are much the more abundant, while in two of the specimens they are scarcely more abundant than the hexacts. The two forms are alike except as regards the distal ray. In the pentacts, the distal ray is represented by a boss which is small and of an irregular, angular shape. In the hexacts the distal ray, which is of varying length, up to 120 μ, may be nearly cylindrical or considerably swollen. Characteristic conditions are shown in Figs. 2 and 6, Plate **8**. —— The tangential rays, which measure about 250 μ x 16–20 μ, have large blunt or rounded teeth on the distal surface and sides, while the proximal surface is nearly smooth, having only a very few such teeth. The rays curve in very slightly, are often nearly straight, taper evenly and slightly toward the end, which is blunt or rounded and not enlarged.—— The proximal ray as a rule is shorter than the tangentials, often about 200 μ long, of about the same thickness as the tangentials, tapering evenly to a point above which it is roughened, elsewhere smooth or with a few scattered minute prickles.

The uncinates vary greatly in size, and exhibit the same difference between the two ends which has been described for *Farrea occa claviformis*. They extend radially or obliquely, often through the entire tube wall. In the wall of the cups numerous large uncinates, commonly about 2 mm. long, are found running parallel to the surface and at right angles to the cup edge.

The discohexasters are of the onychaster type, and are scanty or only fairly abundant. Principal ray is 4–6 μ long; terminal rays, 24–30 μ long. The principal rays are smooth. The terminal rays are slender, taper toward the apex, and are roughened; capped by a minute disc about 3 μ in diameter, which is divided into 4 or 5 claw-like teeth. Spicules occur in which the roughening on the terminal ray is represented by exceedingly minute prickles. Other spicules occur in which one or several of the principal rays, or even all, bear but one terminal each. In such spicules, a "knee" usually marks the passage of the principal into the terminal, but this may not be present.

The common form of dermal scopula, Fig. 3, Plate 8, has 3 or 4 distal rays, which are cylindrical, curved very slightly, covered with minute sharp denticulations, and which terminate in very small, smooth and rounded enlargements. The shaft at its upper end has a definitely circumscribed enlargement on which the rays rest; tapering thence to the point, above which it is roughened; elsewhere smooth. The shaft is 200–240 μ long, and 4 μ thick just below upper enlargement; rays, 40 μ x 2 μ.—— Larger spicules are present in some abundance, in which the number of distal rays varies from 4 to 10. The rays measure 60 μ x 2 μ to 100 μ x 3 μ, and terminate in rounded heads which are usually small, about 5 μ in diameter, but sometimes large, about 8 μ in diameter. The rays are covered with very small sharp denticulations, which enlarge upon the head, sometimes sufficiently to appear as recurving spines. The shaft has a thickness of 6 μ and is somewhat larger than, although otherwise like, that of the typical dermal scopula.

The gastral scopulae, Fig. 2, Plate 8, have 4–6 slender distal rays, 70–80 μ long, which terminate in spheroidal heads. The heads bear, round their equator and over their under surface, recurving spines. The upper surface of the head is smooth, or covered with minute prickles into which the recurving spines gradually pass. The rays usually ascend obliquely, and then diverge rather suddenly, but the precise curvature varies. The shaft is like that of the dermal scopulae, and about 300 μ long by 5 μ thick below the upper enlargement.

The gastral scopulae fall into two classes between which there are transitions. In the one the distal rays are smooth, and gradually enlarge from the base upwards, being 2 μ thick below, 4 μ thick above, then expanding into a large head, 12 μ in diameter, which bears strong recurving spines. In the other form, the distal rays are nearly cylindrical; roughened with minute denticulations; and provided with heads which are small, 8 μ in diameter, and feebly spinose. The first form predominates in the specimens from Station 3359, the second form in those from Station 3358.

It will be seen that in this subspecies there are two extreme types of scopulae, the small dermal form (Fig. 3, Plate **8**) and the gastral scopula, with smooth distal rays (Fig. 2, Plate **8**). The larger scopulae on the dermal surface, and the gastral scopulae with roughened rays, constitute intermediate forms. In the type (Schulze, 1899, p. 75) the dermal and gastral scopulae are alike, and resemble the gastral scopulae of this subspecies, but have spinose rays.

Eurete erectum mucronatum, subsp. nov.

Plate 8, Fig. 7.

Diagnosis. Like *Eurete erectum tubuliferum*, but with oxyhexasters instead of onychasters.

Station 3358, 4 specimens; *Station 3359*, 1 specimen.

In this subspecies there are oxyhexasters instead of onychasters. The oxyhexasters are abundant in some specimens, only fairly so in others. The difference is doubtless due to the extent of maceration. The spicules, Fig. 7, Plate **8**, vary somewhat in size in the different specimens. In the spicules of one specimen the principal ray is 4–6 μ long, the terminals 40–50 μ. In another specimen the principal ray is 4–6 μ long, terminals 32–40 μ. In a third specimen the principal ray is 6–8 μ long, terminals 36–48 μ. In yet another specimen, along with spicules in which the principal ray is 4–6 μ long and the terminals about 40 μ long, are many spicules with relatively long principals. In these the length of the principal reaches 8 μ, while the terminals are 28–32 μ long.—— There are 2 or 3 terminals to a principal. The principal is smooth, the terminals faintly roughened. The terminals diverge considerably, and are nearly straight, or only slightly outcurving, delicate, and tapering to fine points.—— Oxyhexasters occur in which some, or all, of the principals bear but one terminal each, a slight "knee" usually marking the passage of the principal into the terminal.

These sponges resemble in all other respects the specimens described as *Eurete erectum tubuliferum*, and which were taken at the same two stations as the above. While I have separated the two groups of individuals, and designated them as subspecies, it seems to me quite possible that they are merely classes of individuals which differ in respect to a quality of individual variability. Their detailed resemblance in respect to the other structural features suggests that this is the case.

Eurete erectum gracile, subsp. nov.

Plate 8, Figs. 4, 5, 8, 9; Plate 9, Figs. 1, 3, 5.

Diagnosis. Axial part of sponge body forms a *very elongated* spiral. Distal ray of the dermal pinules very thick. Tangential rays of the gastral pentacts and hexacts beset all over with minute sharp prickles. With onychasters. Characteristic dermal scopulae are small forms, in which the distal rays are minutely denticulate, and taper from the base to the apex, which is smooth and not enlarged. Gastral scopulae are large forms, 600–1500 μ long; distal rays slender and with large heads, or stout and tapering from base to apex, and without heads.

Station 3380, 4 specimens.

In these specimens the upper and lower ends of the sponge are not present. The axis, Fig. 5, Plate 9, forms a very elongated spiral, which varies but little in diameter, being 8–10 mm. thick over a length of 150 mm. The cups are much broken, but it may be seen that they are mostly undivided, and that they have a flaring wall. There are, however, some cases in which the cups are partially or completely bifurcated, and it may be seen that in the bifurcation of the cups the same peculiar ridges, or tubular structures, are produced that have been described for *Eurete erectum tubuliferum.* And extending from the cups onto the axis similar structures are found, as in the other subspecies. In the shape and appearance of these structures, however, this subspecies differs somewhat from the others, in that the structures are here strongly compressed ridges, which in side view appear triangular (Fig. 5, Plate 9). The longitudinal character of their arrangement, so conspicuous in the figure, is obviously correlated with the very elongated spiral character of the sponge body.

The dermal pinuli, Fig. 5, Plate 8, differ from those of the other subspecies, *tubuliferum* and *mucronatum*, in respect to the distal ray. This is noticeably thicker, with a more rounded outline, and the lower bare part of the ray is very short. The ray, which may be of the same length as the others, but is often shorter, is commonly about 50 μ thick, and has a bare basal portion about as long as thick, measuring 16 μ x 16 μ to 20 μ x 20 μ. The tangential rays are in general pointed, but exceptionally are rounded and enlarged at the ends, and like the other rays are somewhat thicker than in the two other subspecies. A characteristic spicule has these measurements: distal ray, 120 μ x 50 μ; proximal and tangential rays, 150 μ x 10 μ.——Exceptional forms are found in some of which the development of spines on the distal ray is so great as to obliterate the lower bare part; and others of an opposite character, in which the lower bare part of the ray is nearly as long as in the other subspecies.

The gastralia include pentact and hexact (Fig. 8, Plate 8) forms, which are alike except in respect to the distal ray. The tangential rays differ noticeably from those of the type and subspecies *tubuliferum* and *mucronatum* in that they are beset all over with minute sharp denticulations. This denticulation may be so fine that the ray appears nearly smooth. The proximal ray is also beset throughout its length with similar minute prickles. The tangential rays, which are very slightly incurved, commonly end, as does the proximal, in points, but exceptionally they are rounded and enlarged at the ends. In a characteristic spicule the tangential rays measure 200 μ x 12 μ, the proximal ray 240 μ x 12 μ.——In the pentact forms the distal ray is represented by a small rounded or angular boss. In the hexact forms (Fig. 8, Plate 8), the distal ray, which is 100–150 μ long, is in general more bushy than in the other subspecies, although it varies to a nearly cylindrical spinose shaft, somewhat thickened at the top.

In one of the specimens the hexacts greatly predominate, in the others the pentacts and hexacts are about equally abundant. In one of the latter specimens the spicules vary toward the condition of the type and the other subspecies, in that the tubercles on the tangential rays are strong prickles and are more abundant on the distal surface of the ray.

The uncinates do not differ from those of the other subspecies.

The hexasters are onychasters, Fig. 4, Plate 8. The claws at the ends of the terminal rays are more distinctly developed than in subspecies *tubuliferum*, the diameter of the whole disc being about 4 μ. The principal ray is commonly 8 μ long, the terminals 28–32 μ long. Smaller sizes, with principal ray 6 μ and terminals 20 μ long, are present.

The characteristic dermal scopulae are small forms (Fig. 9, Plate 8). The distal rays, 4 in number, are roughened with minute denticulations, are practically straight and taper conspicuously from the base to the apex, which is smooth, rounded, and not enlarged. The divergence of the rays varies, being sometimes so slight that the rays look nearly parallel. In different spicules the size of the terminal ray varies from a length of 50 μ with a lower diameter of 4–5 μ and an upper diameter of 2 μ, to a length of 70 μ with a lower diameter of 6 μ and an upper diameter of 3 μ. The shaft, about 300 μ long by 6–8 μ wide above, is smooth or nearly so, straight or slightly curved, and tapers evenly to the point. Above it passes gradually into the rays.——The spicule varies. The tapering of the rays may be slight, and a small head may be developed, in which case it is only the slight difference in the shape of the upper end of the shaft which distinguishes the spicule from the dermal scopula of subspecies *tubuliferum*.

Mingled with the dermal scopulae just described, and quite as common, are scopulae 600–700 μ long, with 4–6 nearly cylindrical roughened rays 70–100 μ long by 3–5 μ thick. The rays terminate in small and feebly spinose heads, 6 μ in diameter, or in large and strongly spinose heads up to 12 μ in diameter. This type of scopula is similar to the smaller forms found on the gastral surface. The characteristic dermal scopula (Fig. 9, Plate 8), also resembles in shape one of the gastral forms (Fig. 1, Plate 9), although it is very much smaller.

The gastral scopulae, Figs. 1, 3, Plate 9, are large forms 600–1500 μ long, the commonest sizes ranging between 600 and 800 μ. The larger forms frequently penetrate the entire tube wall, even where the latter consists of 5 or 6 layers of beams. The shaft is 8–16 μ thick, pointed, smooth, or with a few denticulations. Above it has not a definitely circumscribed enlargement, but passes gradually into the rays. The rays, 3 to 6 in number, 100–120 μ long, are nearly straight and are covered with exceedingly small denticulations.—— With regard to the precise shape of the distal rays, the spicules vary between two extremes. At one end of the series are found scopulae (Fig. 3, Plate 9), in which the rays are cylindrical, 4–5 μ thick, passing above into large rounded heads 12 μ in diameter, which bear recurving spines. This type is like the corresponding scopula of subspecies *tubuliferum*, except in its greater size and in the comparative straightness of its terminal rays. The other extreme is represented by a scopula (Fig. 1, Plate 9), usually one of the longest, in which the terminal rays are very stout and taper conspicuously from below upward. The lower diameter of the ray is about 12 μ, the upper diameter 6 μ, and the ray ends in a smooth and not enlarged, rounded, or conical extremity. Immediately below the extremity the denticulations are enlarged and form short recurving spines.—— Between these two extreme types of gastral scopulae are found intermediate forms in which the distal rays taper slightly or considerably from the base upward, and end in strongly or very feebly spinose heads which vary from a very small size, 6 μ in diameter, to a large size, 12 μ in diameter. The extreme apex of the head may be smooth, or denticulations may be here developed.

Eurete, sp.

At *Stations 3370* and *3380,* 4 specimens belonging to *Eurete* were obtained. The specimens are completely macerated, the dictyonal framework alone remaining, and thus do not admit of a more precise identification.

MELITTIONIDAE Zittel.

Aphrocallistes Gray.

1858. *Aphrocallistes* Gray, 1858, p. 114.
1887. *Aphrocallistes* Gray, Schulze, 1887, p. 310.
1899. " " , Schulze, 1899, p. 110.

Aphrocallistes vastus F. E. Schulze (sp. ?).

1887. *Aphrocallistes vastus* Schulze, 1887, p. 317, Plate LXXXV.
1899. " " Schulze, 1899, p. 86, Taf. XVIII. Fig. 3.

Station 3370, 1 specimen.

The specimen is a plate-like fragment including only the dictyonal framework. I have compared the fragment directly with specimens and preparations of *Aphrocallistes vastus* F. E. Sch., and find an essential agreement between it and the dictyonal framework of this species. Nevertheless, owing to the absence of the free spicules, the identification must be regarded as uncertain.

The plate is about 5 mm. thick, and the radial canals something over 1 mm. wide. The skeletal beams are mostly 80–100 μ thick; meshes of the lattice-work frequently rectangular and measuring commonly 200 μ x 200 μ to 680 μ x 425 μ, larger sizes not infrequent. The axial canals are arranged in the several ways described by Schulze (1887, p. 318). In these points there is agreement with *A. vastus.* In some minor features there is not agreement. Thus the beams are smooth, and the spines (pegs) are shorter and stouter than is the rule in *A. vastus,* also less abundant. The specimen has apparently long been dead, and the axial canals are wide (0.2 to 0.3 diameter of the beams) and very distinct.

The "Challenger" specimens of *A. vastus* were from Sagami Bay, Japan. The "Albatross" specimens on which Schulze reports (1899) were taken "along the whole west coast of North America from the Aleutian Islands to the Bay of California" at 13 different stations.

COSCINOPORIDAE Zittel.

Chonelasma F. E. Schulze.

1887. *Chonelasma* Schulze, 1887, p. 320.

Chonelasma calyx F. E. Schulze (sp. ?).

Plate 10, Fig. 5.

1887. *Chonelasma calyx* Schulze, 1887, p. 326, Plate LXXXIX.
1899. " " Schulze, 1899, p. 78, Taf. XIX. Fig. 5.

Station 3354, 3 imperfect specimens in which only the dictyonal framework is preserved. The identification is therefore in a measure uncertain, although a direct comparison with *C. calyx* makes it probable that the "Albatross" specimens belong to this species.

As in many of Schulze's specimens of *C. calyx* from the west coast of America (Schulze, 1899, p. 79), the lower part of the body forms a stalk. The stalk is roughly cylindrical, about 10 mm. in diameter and up to 40 mm. long. It expands below to form a basal plate, the under surface of which is smooth. The vase-shaped body, into which the stalk passes, has a wall 2–4 mm. thick. In the best specimen the vase is somewhat cylindrical, beginning to flare in its upper part, where it is broken off. In this individual the cavity of the vase is crossed by an oblique septum, perforated by several large apertures (Plate **10**, Fig. 5). The septum is very thin, and is composed of delicate strands which form a coarse reticulum.

The skeletal framework at the outer surface is irregularly arranged so as to bound rounded apertures. On the inner surface a fairly regular crossing of circular and longitudinal fibres is obvious. This contrast between the two surfaces exists in *C. calyx*, but also in other species of *Chonelasma* (*C. tenerum* F. E. Sch., Schulze, 1887; *C. lamella* F. E. Sch., Schulze, 1887).

The nearly parallel trabecular plates (*Balkenzüge*) described by Schulze for *C. calyx* (Schulze, 1899, p. 78) as lying edgewise to the surface of the body and extending from below upward are distinctly marked in my specimens.

In the specimens of *C. calyx* from Japan described by Schulze (1887, p. 326) the dictyonal framework consisted "partly of perfectly smooth beams and partly of beams sparsely covered with tubercles," whereas in

Schulze's American specimens (1899, p. 81) the beams are almost everywhere abundantly covered with fine prickles. In my specimens, in the wall of the vase almost all of the beams are smooth, but beams abundantly covered with exceedingly fine prickles are occasionally met with. On the other hand, in the stalk beams densely covered with fine prickles predominate.

In my specimens, as in Schulze's American specimens of *C. calyx* (1899, p. 79), the dictyonal skeleton of the stalk (especially in its outer part) is far more compact than that of the vase wall, and in this region large numbers of the peculiar oxyhexacts are found, the rays of which bear small transverse spines.

The "Challenger" specimens of *Chonelasma calyx* were from Japan. The "Albatross" specimens described by Schulze (1899) were taken at 9 different stations off the west coast of North America from the Aleutian Islands to the southern end of Lower California.

Bathyxiphus F. E. Schulze.

1899. *Bathyxiphus* Schulze, 1899, p. 82, Taf. XVII. XVIII.

Bathyxiphus, sp.

Plate 10, Fig. 2.

Station 3380, 1 specimen.

The specimen includes only the dictyonal framework. The arrangement of the beams in the framework and the shape of the body are, however, so characteristic as to leave little room for doubt that the sponge belongs in the genus created by Schulze for specimens taken in the same general locality as this.

There is a basal disc about 55 mm. in diameter (Fig. 2, Plate **10**). From it a solid stem, which has a length of 120 mm., rises obliquely. The stem at its very base is irregularly cylindrical, soon becoming lenticular in section, with transverse axes of 12 mm. and 7 mm. respectively. The stem above becomes gradually more compressed, being quite flattened at its upper end, where it measures 15 mm. from edge to edge, and about 3 mm. in the short transverse axis. The flattened upper end is notched in the middle, and is thus divided into two very short flattened diverging lobes. These have rounded outlines, but as the specimen is somewhat waterworn, it is by no means certain that they represent the upper end of the perfect sponge. There is, however, a clear indication that the sponge bifurcates above.

The lateral edges of the lenticular, or flattened, stem are everywhere rounded, nowhere sharp. At the upper end, however, in the above-mentioned notch, the free edge becomes thin and comparatively sharp. The stem is slightly curved in a wave-like fashion both along its edges and its flattened faces, but very vaguely and in a less regular fashion than in Schulze's specimens of *B. subtilis*. The wave-like contours nevertheless suggest that the growth is a bilateral modification of the spiral form. It may here be mentioned that a strongly bilateral modification of the spiral form is exhibited by some of the macerated specimens, which I mention under *Eurete erectum*, p. 58. In one of these, over a tract 70 mm. long, the curves of the stem lie nearly in one plane, and the lateral cups form two linear series, which are distributed along the opposite curved edges of the sponge, the curved edge presenting a wave-like contour from the convexities of which arise the cups.

The dictyonal framework has the structure described by Schulze. In the middle of the compressed stem there are longitudinal beams with more or less transverse connectives, the system thus giving fairly rectangular meshes. The longitudinal beams on each side curve outward toward the edge of that side and the upper end, in some cases obviously branching acutely. Connectives extend transversely between these beams and at about right angles to them, and thus make an angle with that horizontal axis of the sponge which runs from edge to edge of the stem. Typically the connectives form continuous lines which extend from edge to edge of the stem, and are strongly arched toward the apex of the sponge, precisely as described by Schulze for *B. subtilis*. There are of course departures from this plan, owing to the fact that some connectives lie in the transverse axis of the stem, others extend outward and *upward*, and at some levels the connectives do not form continuous lines.

Away from the median plane, going toward each face of the stem, the skeletal meshwork becomes irregular. Near and at the surface, the beams are much slenderer and the meshes larger than farther in.

Abundant small hexacts are present. It should also be mentioned that a few hexact pinuli and scopulae were observed. Since these, however, resemble the corresponding spicules of *Eurete erectum gracile*, specimens of which were collected at the same station with the *Bathyxiphus*, it is probable that they belong to the former sponge.

Bathyxiphus subtilis F. E. Sch., the type on which the genus is based, was taken by the "Albatross" south of Guadeloupe Island off Lower California, Lat. 28° 57′ N., Long. 118° 14′ 30″ W., at a depth of 1251 metres on a mud bottom.

TRETODICTYIDAE F. E. Schulze.

Hexactinella Carter.

1885. *Hexactinella* Carter, 1885, p. 387.
1887. *Hexactinella* Carter, Schulze, 1887, p. 328.

Hexactinella labyrinthica, sp. nov.

Plate 10, Figs. 6, 7; Plate 11, Figs. 1–7.

Station 3405, 1 entire specimen and 3 fragments.

Diagnosis. Sponge body a labyrinthine mass of branching and anastomosing flattened or subcylindrical lobes. These are beset with numerous rounded oscula leading into short cloaca-like main canals. The dermal skeleton includes pentacts, with more or less radially disposed scopulae and *roughened oxydiacts.* The parenchymal microscleres are oxydiacts and discohexasters.

The entire specimen (Fig. 6, Plate **10**) forms a hemi-spheroidal mass which has a diameter of 60–80 mm., and is attached below to conglomerate. The lobes very commonly have a thickness of about 6 mm., and the sponge has the appearance of having been produced by a continued branching and anastomosing growth, which started from the centre of the lower or attached surface. The oscula are about 2 mm. in diameter, are bounded by a narrow border of oscular membrane, lie on the surfaces which face outward, and are not on special elevations. The cloaca-like main canals extend radially or obliquely into the interior for a short distance only, 3 or 4 mm. Into them open numerous efferent canals.

The surface of the sponge appears porous, owing to the very numerous afferent canals, the outer ends of which abut against the dermal membrane. The outer ends of these canals are in general rounded and vary in size up to 1 mm. in diameter. The dermal membrane covering them is riddled with pores (Fig. 7, Plate **11**). In spots, especially in the neighborhood of the periphery of the colony, where the lobes are attached to the substratum, afferent canals large enough to be noted by the eye are absent, and the surface has a homogeneous appearance, which is perhaps the earlier ontogenetically. The pores, which vary considerably in size, are thickly scattered over the whole dermal surface, not only directly over the conspicuous afferent canals, but in the regions between such, where the dictyonal framework and the flagellated chambers closely approach the surface (Fig. 7, Plate **11**).

A small tubularian hydroid, the polyps of which have four tentacles and are borne upon a slender, ramifying stolon, is present in considerable abundance in the tissues of this sponge. The polyps lie especially in the peripheral region, and cause no elevations or apparent malformations.

The tissues also contain (Fig. 7, Plate **11**) exceedingly numerous rounded or irregularly shaped masses up to 120 μ in diameter. These are frequently nearly or quite in contact, so abundant are they. Their histological condition does not admit of exact study, but it may be seen that they are composed of closely packed rounded bodies about 4 μ in diameter. They are doubtless collections of archaeocytes such as Ijima has recently described (Ijima, 1901).

It is difficult to carry out in this sponge the distinction between a dermal surface and a gastral surface. If we do adhere to the latter conception, it is obviously only the walls of the cloaca-like main canals which represent the gastral surface. But such walls are of course something quite different from the inner surface of a cup-shaped plate, such as, for instance, in *Hexactinella ventilabrum* is usually denominated the gastral surface.

The dictyonal framework is fine, far more so, for instance, than that of *H. ventilabrum* F. E. Sch. On parts of the surface the reticulate plates characteristic of the genus are obvious, their superficial edges being not at all or scarcely united. Elsewhere the superficial edges of the plates are united by skeletal strands. In this way a surface network is produced, enclosing rounded or elongated apertures and obscuring the system of plates. The reticulate plates are something less than 1 mm. to 1.5 mm. wide at the surface, and 1 mm. or less apart. They taper internally to an apex, meeting and fusing with one another, as they get farther from the surface. They are of varying thickness, in places consisting of but a single layer of beams, generally of a few (2 to 4) such layers. The individuality of the skeletal plates, both at and internal to the surface, is far more distinct in certain regions than in others, depending on the extent to which connectives have developed. The plates are always set edgewise to the surface, and in any particular part of the sponge body they may be seen, in the macerated skeleton, to extend in a very general way in one direction, which in some cases obviously corresponds to the long axis of the lobe. Owing to the labyrinthine habitus of the sponge body, it is impossible in other cases to determine which is the long axis of a particular part.

The arrangement of the constituent beams of the skeletal plate has a certain regularity. Beams directed radially to the surface of the sponge may be distinguished, between which lie connectives. The latter are frequently transverse, thus giving rise to rectangular meshes, Figs. 1 and 7, Plate **11**. The superficial ends of the radial beams form tapering spines of varying length, sometimes very short, frequently as long as 350 μ, often slightly irregular, and as a rule thickly covered with sharp microtubercles. The beams in general are sparsely covered with similar tubercles, and most commonly have a thickness of 20–30 μ. A similar difference in tuberculation between the ends of the radial beams and the general framework exists in *Hexactinella grimaldii* Tops. (Topsent, 1892, p. 34), and according to Topsent (1892) in *H. tubulosa* F. E. Sch.

From the nodes of the skeletal reticulum, on the free surfaces and edges of the plates, slender, sharp, tuberculated spines very generally project, Fig. 1, Plate **11**. Some of the very delicate connecting bars which extend between adjoining skeletal plates (lower left corner and at extreme right, Fig. 1, Plate **11**) make the impression of having arisen through the fusion of such spines.

Commonly the outermost tangential beams of the dictyonal framework lie at some considerable distance below the dermal membrane (Fig. 7, Plate **11**). This is not always so, for in places they nearly, and more rarely quite, reach the surface, aiding in support of the dermal membrane. The lining membrane of the cloaca-like main canals is likewise in places directly supported by beams of the framework, placed tangentially to this membrane.——The attached surface of the sponge lobes is comparatively smooth, the dictyonal framework here forming the familiar close meshwork or "cribellate plate" (Ijima) found in so many Hexactinellid sponges.

In spots at the surface the dictyonal framework is covered with collections of delicate hexacts and pentacts, partially fused with one another and with the framework (Fig. 7, Plate **10**). The spicule rays, which are often irregularly curved to a slight degree, may simply cross one another, or may be united by distinct masses of cement. The rays are as a rule noticeably thorny, and about 160 μ x 3–5 μ. In such spots the usual covering of dermal pentacts is absent or nearly absent.

At the same station at which these specimens were obtained, a species of *Tylodesma* (*T. vestibularis*) was taken, growing upon and through a dead Hexactinellid skeleton, which seems unquestionably to belong to *H. labyrinthica*. In this skeleton, reticular masses formed by the fusion of delicate spicules, like those just described, are abundant. The fusion, however, is more complete, and often so intricate that the individuality of the constituent spicules cannot be made out. The masses of spicules here are found chiefly in the interior, and in some cases form continuous layers, which like a partition wall separate one part of the sponge from another part.

In both cases the reticular masses obviously fall in the category of the peculiar structures found in so many Hexactinellids and described especially by Weltner: "An einer Reihe von Dictyoninen finden sich eigenthümliche Nester von Gitterwerken, zusammengesetzt aus Sechsstrahlern, [pentacts also in *Myliusia zittelii* Marsh.] welche ohne alle Ordnung zu einem Haufen miteinander verbunden waren" (Weltner, 1882, p. 56). In *H. labyrinthica*, the collections of these spicules suggest a pathological condition.

The dermal pentacts, Fig. 5, Plate **11**, vary a good deal in size (Fig. 6, Plate **11**). In the larger, the tangential rays measure about 250 μ x 18 μ, proximal ray about 380 μ x 20 μ. The distal ray is reduced to a boss from 50 μ to almost nothing in height. All rays are commonly pointed, sometimes blunt or rounded at the ends, and are covered with sharp microtubercles, which are, however, very feebly developed in the smaller spicules. A surprisingly frequent condition of the rays is shown in Figs. 5 *b* and 5 *c*, Plate **11**. The ray which may be tangential or proximal suddenly narrows once or twice before reaching its end. Over the larger inhalent canals, the pentacts commonly have proximal rays which are shorter than elsewhere (Fig. 7, Plate **11**).——The pentacts are very abundant, and the tangential rays overlap. While the arrangement of these rays is not strictly regular, square meshes are common, and frequently a smaller pentact is so placed in a square mesh as to divide the latter into four triangular areas (Fig. 6, Plate **11**). The covering of pentacts comes to an end at the margin of the attached surface of the sponge, and at the margin of the oscula, although in the lining membrane of the cloaca-like main canals a very few scattered pentacts are found.

The scopulae (Fig. 4, Plate **10**, Fig. 2, Plate **11**) vary in size, but in other respects are alike. The shaft tapers to a fine point. Above, nearer the rays, it is nearly smooth, while below it is distinctly roughened with sharp denticulations. Just below the rays is a terminal enlargement on which the rays are set. The rays are four in number, only very slightly divergent, roughened with minute though distinct denticulations which die away at the base. The upper ends of the rays are rounded and slightly enlarged. The extreme upper end is smooth. In the larger scopulae the shaft is about 580 μ long and 8 μ thick just below the upper enlargement; rays 80 μ long x 7 μ thick at the base. The smallest forms seen were about two-thirds the size of the largest.—— The scopulae are in part scattered through the interior of the sponge, in part arranged radially or obliquely to the dermal membrane and to the lining membrane of the main canals. Scopulae also lie in or project into the rim of membrane which surrounds the oscula. A dermal scopula is usually found together with a few oxydiacts, all forming a loose sheaf associated with the proximal ray of a pentact. The scopulae, like the accompanying oxydiacts, may not reach, or may project slightly beyond, the dermal membrane.

The dermal oxydiacts are arranged radially or obliquely to the surface, singly or in small loose sheaves, often associated with the pentacts. The spicules are roughened, taper to fine points, and vary in size, the larger measuring about 600 μ x 5 μ. Smaller forms down to 200 μ x 2 μ are found. The larger are abundant. On these it may be seen that the roughening is of a definite character, Fig. 4, Plate **11**. The minute denticulations project obliquely from the shaft and in one direction, pointing when the spicule is in place away from the dermal membrane. Toward each end of the spicule, the denticulations lose their definite character, and it is not always equally distinct on all parts of the shaft. —— In the parenchyma are abundant oxydiacts, similar to the dermal forms, although the larger sizes are relatively less common.

In *Hexactinella ventilabrum* F. E. Sch., Schulze (1887, p. 331, Plate XCVI.) has described roughened oxydiacts, which he regards as possibly representing uncinates. The denticulations have not the oblique character I have just described. Topsent (1901) likewise finds in his *Eurete alicei* nicked oxydiacts, which he considers as a form of uncinate. The oblique character of the denticulations in the larger oxydiacts of *H. labyrinthica* inevitably suggests that they too are to be regarded as representing uncinates.

Discohexasters, Fig. 3, Plate **11**, are abundant in the parenchyma. The principal rays are smooth, the terminals roughened and exceedingly slender. A principal bears 3 or 4, rarely only 2 terminals. The buttons at the ends of the terminal rays are minute. The principals are commonly 5 μ long, the terminals 20 μ long, although somewhat smaller sizes are present.

Hexactinella ventilabrum Carter (sp.?).

1885. *Hexactinella ventilabrum* Carter, 1885, p. 397, Plate XIV., Figs. 1–10.
1887. *Hexactinella ventilabrum* Carter, Schulze, 1887, p. 331, Plate XCVI.

Four fragmentary specimens from *Stations 3359, 3404, 3406.*

These specimens include only the dictyonal framework, and the identification is therefore in a measure uncertain, although a direct comparison with specimens of *H. ventilabrum* makes it probable that they belong to this species.

The largest piece is a plate about 120 mm. wide and 7–10 mm. thick. The plate is comparatively smooth on one surface, but very uneven on the opposite surface, owing to the development of irregular protuberances and ridges, which for the most part are about 10 mm. high. The dictyonal framework exhibits the reticulate plates, which are characteristic of the genus. They curve toward both surfaces, and are made up of beams, which are covered with very small, sharp microtubercles. Except at and close to the surfaces of the sponge, where they are conspicuously thickened, the beams have a thickness commonly in the neighborhood of 80 μ. The meshes more frequently are irregular in shape, but in places are square or rectangular. Selected and fairly typical meshes of this character measured 425 μ x 300 μ, 340 μ x 250 μ, 250 μ x 250 μ. Much coarser meshes exist. —— The distance between the reticulate plates is about 2 mm. The framework is thus a coarse one.

As in Schulze's specimens of *H. ventilabrum* (and in other species of *Hexactinella* also), there is a marked difference in the appearance of the opposite surfaces of the sponge. On the one surface the free margins of the reticulate plates may be seen, the surface network here being formed by these margins and by beams which extend between them. On the opposite surface the reticulate plates are covered in by an "evenly expanded fibrous network" (Schulze, 1887, p. 331).

The sponges had probably long been dead when taken, for the axial canals are wide and distinct, making it easy to observe the various ways in which the hexacts are combined to form the dictyonal skeleton. It may thus be seen that two parallel rays of different hexacts may fuse to form a beam; or the beam is formed of a single ray, which at its tip fuses with the side of the ray of another hexact, or crosses this ray, fusion occurring at the point of crossing. Far less common is the case where two or even three rays of the same hexact are so curved as to lie nearly parallel to one another and to fuse. Such a condition is found occasionally in the thicker beams at or near the surface.

Hexactinella ventilabrum F. E. Sch. has hitherto only been recorded from Japan.

Hexactinella tubulosa F. E. Sch. (sp. ?).

1887. *Hexactinella tubulosa* Schulze, 1887, p. 328, Plate XCIII.

At *Station 3406* a small fragment was obtained, including only the dictyonal framework. The fragment, which is about 30 mm. long, is tubular, and represents the end of a cylindrical branch about 10 mm. in diameter. The skeletal plates are separated by an interval of about 2 mm. The resemblance of the fragment to a Japanese specimen of *H. tubulosa* in the Museum für Naturkunde in Berlin is so close as to make it exceedingly probable that the sponge belongs to this species. Through the kindness of Professor Wilhelm Weltner I was allowed to make preparations of the Japanese specimen, which I find is undoubtedly referable to Schulze's species, although the anastomosis between the skeletal lamellae is feebler than in the specimens described by Schulze (1887), and the lamellae are distinct at the dermal as well as at the gastral surface.

At *Stations 3380* and *3406* four other macerated fragments were obtained, including only the dictyonal framework. These represent some tubular species of *Hexactinella*, probably *H. tubulosa.* The diameter of the branches is 10–20 mm. The axial cavity is large as compared with the thickness of the wall. For instance, in a branch 20 mm. wide, the width of the axial cavity is 10 mm.——The skeletal reticular plates are about 2 mm. apart. At the dermal surface they are abundantly connected by anastomoses so as to produce a reticulum with rounded polygonal meshes about 2 mm. in diameter, agreeing in this respect with the specimens described by Schulze (1887, p. 329).

Hexactinella tubulosa F. E. Sch. has hitherto been recorded only from Japan.

Sclerothamnopsis compressa, gen. et sp. nov.

Plate 9, Figs. 2, 4, 6-8, 10, 11; Plate 10, Figs. 1, 3.

Diagnosis. Dictyonal framework a close reticulum not divisible into lamellae. Beams of the reticulum may give rise to fibres, which pursue a longitudinal course in places, curving outward to the surface. The entire framework has the shape of a branching axis. The main axis and the branches all lie approximately in one plane, and all are distinctly flattened. Free spicules not known with certainty.

At *Station 3406* five fragmentary and macerated specimens were taken of this remarkable sponge, which finds its nearest ally in *Sclerothamnus clausii* Marshall. The most perfect piece is represented in Fig. 1, Plate **10**.

The body of the skeleton consists of a branching axis, which is not cylindrical, but distinctly flattened. From the flattened surfaces of the axis the branches project obliquely upward, some of them reuniting with the axis above. The branches and the main axis all lie approximately in one plane, the whole sponge (fragment) thus acquiring a habitus, which is not bushy but flattened. The branches themselves are flattened and like the axis in planes vertical to that in which the sponge body spreads. The branches vary in size, some being nearly as thick as the axis, others thin and small. Neither the base nor the upper end of the sponge is included in the specimens, the largest of which measures 150 mm. in length, the transverse diameters of the axis being about 10 mm. and 20 mm.

The macerated skeleton appears as a dense stony mass, the surface of which is studded with the round apertures, mostly about 0.5 mm. in diameter, of small canals passing into the interior. Here and there cylindrical, canal-like spaces of considerable size, 3 to 6 mm. in diameter, pass in an obliquely longitudinal direction through the axis or branch, from one flattened face to the opposite (Fig. 2, Plate 9). Or, instead of such perforating canal-like spaces, the branch may exhibit elongated clefts (Fig. 2, Plate 9, Fig. 3, Plate 10), which likewise pass through from one flattened face to the other. The two structures probably belong in the same category.

The stony skeleton is the dictyonal framework of the sponge. This consists of a close reticulum (Fig. 11, Plate 9), which is not divisible into lamellae. In the peripheral region of the sponge, beams directed more or less radially to the surface, with intervening connectives, may be distinguished. The radial beams commonly terminate at the surface in bosses or spines, which are sometimes short and conical, more often slender and finger-like. The superficial bosses, like the beams themselves, are smooth. The meshes have rounded corners, are irregular in shape, but in the peripheral region tend toward a quadrilateral outline. The nodes of the reticulum are for the most part not conspicuously thickened, but sometimes they are. The thickness of the beams is very commonly about 50 μ.

In places the beams of the dictyonal framework are so arranged as to give the framework a fibrous character. The fibres which lie in the long axis of the stem or branch are visible here and there over the general surface. They may also be traced with some distinctness in longitudinal sections, which are cut either parallel or at right angles to the flattened faces of the skeleton. The fibres are distinct on the walls of the large canals or slits which perforate the sponge, and here they are especially conspicuous on the walls which are parallel to the *edges* of the flattened branches, and less conspicuous on the walls which are parallel to the *faces* of these branches. The longitudinal fibres are especially distinct in some of the very small and thin branches, Fig. 4, Plate 9, where they arch outward toward the surface of the branch.

Spinose hexacts (Fig. 10, Plate 9) are scattered in considerable number through the dictyonal framework. They are free, or fused with one another, at points where the rays cross. The rays are slender and beset with small, sharp spines, which are sometimes obsolete. In the same spicule the rays often differ in length, but a common size is about 100 μ long x 4–5 μ thick. The ends of the rays are pointed, or sometimes enlarged and rounded.

A very few pinules, having the peculiar character shown in Fig. 6, Plate 9, are present, some at the surface, others caught in the skeletal reticulum. The distal ray is stout, solid, and covered with exceedingly small, sharp scales, except at its lower end, which is smooth. The tangential and proximal rays are about cylindrical, slender, and smooth, except near the end, where the ray is roughened. The distal ray is 130 μ long, with a greatest thickness of 56 μ. The tangential rays measure 100 μ x 4–5 μ; proximal of same thickness as the tangentials, but longer.

Slender, smooth, nearly cylindrical oxydiacts, 6–8 μ thick, are found here and there lodged in the dictyonal framework. The spicules are always broken, but the length is often over 0.5 mm.

Oxyhexasters (Fig. 7, Plate 9) with smooth slender rays are present in some abundance in the skeletal framework, often occurring in clumps. The terminals, of which there are commonly two to a principal, diverge considerably, are very slightly curved, taper to fine points, and are larger than the principals. The principal ray is about 12 μ, the terminals about 24 μ long.

A very few scopulae (Fig. 8, Plate 9) are present, all of the same type. It is of course uncertain whether they belong to the sponge. The shaft is smooth, tapers gradually to a point, and measures 700 μ x 10 μ. There are four terminal rays, 130 μ long, with a basal thickness of 12 μ. The terminals are straight, smooth, taper conspicuously from the base to the apex, which is rounded and scarcely enlarged. The spicules, like the whole skeleton, have evidently lain long in the water, and the axial canals are very large and distinct. The latter, which are shown in the figure, are of some interest as bearing upon the morphology of the spicule. From the axial cross which lies immediately below the terminals, there is prolonged in one direction the canal of the shaft. On the opposite side canals are prolonged for a short distance into the terminal rays, and end in rounded extremities.

Schmidt (1880, p. 38) conceives the scopula as a modified hexact, and in cases where there are five distal rays interprets these and the shaft as representing the six hexact rays. Schulze (1887, p. 34) argues against this interpretation, and is disposed to regard the distal rays (teeth) as comparable with "the terminal rays of the rosettes." The arrangement of the axial canals in the scopulae here described supports Schulze's interpretation. The terminal rays of the scopula would seem to represent branches of that hexact ray which lies opposite the shaft. The ray in question, which would correspond to the principal ray of a hexaster, is reduced to a minimum, as sometimes occurs in hexasters. Thus the whole scopula corresponds, as Schulze (1887) suggests, to a diact with one long ray (shaft) and one exceedingly short ray, which is produced into branches.

The sponge here described offers many points of resemblance in habitus and dictyonal framework to *Sclerothamnus clausii* Marsh., the type specimens of which, owned by the Rijks-Museum in Leiden, I was permitted to examine. The more perfect specimen is a large and beautiful one. While this specimen is bushy as Marshall (1875) states, it is nevertheless as a whole compressed, one horizontal diameter of the colony being several times as great as the other. The branches themselves also are in places not cylindrical, but somewhat compressed. The dictyonal framework is very coarsely porous as compared with the dense compact skeleton of my species.

Sclerothamnus clausii contains (Schulze, 1887) the following free spicules: dermal hexacts, floricome-like hexasters, dermal scopulae, uncinates, scopula-like spicules with transverse spines on the shaft. The pinules (Fig. 6, Plate IX.) present in my species are very few in number, but they are so peculiar that it seems likely they belong to the sponge. The oxyhexasters, oxydiacts, and spinose hexacts are present in considerable numbers, and doubtless belong to the sponge. Thus there would seem to be a serious difference in the matter of the free spicules between *Sclerothamnus* and *Sclerothamnopsis*.

The Leiden specimens of *Sclerothamnus clausii* were obtained from an unknown locality. Steere's (Murie's) specimen came from the Philippine waters. The "Challenger" fragments were trawled Lat. 4° 31′ 0″ S., Long. 129° 57′ 20″ E., at a depth of 360 fathoms, on volcanic mud.

TETRACTINELLIDA Marshall.

CHORISTIDA Sollas.

THENEIDAE Sollas.

Thenea Gray.

1867. *Thenea* Gray, 1867, p. 541.
1888. *Thenea* Gray, Sollas, 1888, pp. 59, 95.
1894. *Ancorina pars* Lendenfeld, 1894, p. 96.
1894. *Thenea* Gray, Topsent, 1894, p. 375.
1898. " " Thiele, 1898, p. 21.
1902. " " Topsent, 1902, p. 10.
1903. *Ancorina* (*Thenea*) O. Schm., Lendenfeld, 1903, p. 53.

Thenea fenestrata (O. Schmidt) Sollas.

Plate 13, Figs. 2-4, 6, 7, 9.

1880. *Tisiphonia fenestrata* O. Schmidt, 1880, p. 71, Taf. X. Fig. 2.
1882. *Thenea muricata* (Bwk.) Gray *pars*, Vosmaer, 1882, pp. 6, 7, 13.
1885. " " " " , Vosmaer, 1885, p. 4.
1888. *Thenea fenestrata* (O. Schmidt) Sollas, 1888, p. 71, Pl. VIII. Figs. 1–8.
1903. *Ancorina* (*Thenea*) *fenestrata* (O. Schm.) Lendenfeld, 1903, p. 55.

Station 3400, 8 specimens; *Station 3413*, 3 specimens; *Station 3362*, 5 specimens.

The specimens are all small, the diameter ranging from 15 to 25 mm. Both upper and lower surfaces are convex, but the shape of the body varies considerably, being in some cases (Fig. 2, Plate **13**) strongly compressed in the vertical axis, in others (Fig. 9, Plate **13**) compressed in one of the horizontal axes, and again with all the axes about equal. The upper surface bears a single osculum, more or less centrally or very excentrically placed, at the apex of a protuberance. The osculum is commonly surrounded by a dense spicular fringe up to 3 mm. high, but the fringe is absent in some specimens. The color is grayish. The surface is comparatively even, and in general hispid to the eye, but appearing smooth on parts of some specimens. From the under surface several slender roots project, most of which are broken off close to the body.

The pore areas vary in number from two to four, and are separated by comparatively wide intervals. The width of the area (in the horizontal plane of the sponge) is often about equal to the height (Fig. 9, Plate **13**), but again much greater, as in Fig. 2, Plate **13**. The margin is whitish and tumid, projecting out as a thin membrane where the spicular fringe is well developed; the membrane including the bases of the fringe spicules. The fringe itself is in most cases well developed along the upper margin, feebly developed or absent along the lower margin of the area. But in a few areas it is well developed on both margins, and in a few is absent from both margins. The areas are depressed, and the pore membrane lining the area covers in a subdermal cavity which is continued into several afferent canals. The flagellated chambers are eurypylous, and measure about 50 μ in diameter.

Megascleres.

1. Dichotriaene; rhabdome, 3.5 mm. long with greatest thickness of 70 μ; protocladus, 180 μ x 50 μ; deuterocladus, 1.0 mm. long with basal thickness of 35 μ. Smaller forms are abundant, down to such as have a rhabdome, 2.2 mm. x 52 μ, protocladus, 125 μ long, deuterocladus, 440 μ long.

In most of the spicules, the rhabdome is thickest immediately below the cladome, thence tapering to the point. In some spicules, the rhabdome is slightly constricted immediately below the cladome, then expanding and subsequently narrowing and tapering uniformly to the point, as in the protriaene shown in Fig. 6, Plate **13**. The greater part of the rhabdome is quite slender, and somewhat curved. The protocladus is inclined more or less upward, thus making an angle of 80° to 45° with the rhabdome prolonged; angle commonly near 70°. The deuterocladus is straight, or more often slightly curved upward near the base, thence about straight.

2. Protriaene, Figs. 4, 6, Plate **13**; rhabdome, 3–4 mm. long with a greatest thickness of 50–60 μ; cladus, 400–700 μ long x 35–40 μ thick at the base.

The rhabdome exhibits a dilated portion below the cladome. The cladi make an angle of about 45° with the rhabdome, and are usually curved, rarely nearly straight. The curvature of the cladi varies considerably in character (compare Figs. 4 and 6, Plate **13**). —— The protriaenes are obviously modified dichotriaenes. Transitional forms to the dichotriaene (Fig. 7, Plate **13**) are rather more abundant than the perfect protriaene. In these transitional forms the relative lengths of protocladus and deuterocladus are very variable. —— The protriaenes, perfect and imperfect, are present in small number, and chiefly in the neighborhood of the pore areas and the osculum.

3. Anatriaene; rhabdome, 4 mm. x 12 μ; cladus, 260 μ long. The spicules range down to forms with rhabdome 2 mm. x 8 μ, and cladi 140 μ long.

The rhabdome is cylindrical, tapering gradually to the apex. The cladome is deep (the sagitta longer than the chord), but the precise shape of the spicules varies. The anatriaenes are only fairly abundant, occurring in the parenchyma and in the fringes surrounding the osculum and pore areas.

4. Oxea. The very numerous oxeas which are abundant in the body, roots, and fringes fall into four classes, which shade into one another. *a.* Large oxeas, 7.5 mm. x 70 μ to 4 mm. x 35 μ, smooth, tapering. Many are dilated in the middle region, and thus fusiform; others more cylindrical in shape. Abundant in the parenchyma and roots; smaller sizes in the fringe round osculum. *b.* Very slender oxeas, 3–6 mm. long x 10–20 μ thick; cylindrical, tapering at both ends. Common in the parenchyma and roots; chief spicule in the fringes round the osculum and pore areas. *c.* Comparatively short and stout oxeas, 2–3 mm. long x 50–70 μ thick; fusiform. Common in the parenchyma. *d.* Small oxeas, 650 μ to 1.0 mm. long x 8–10 μ thick; common in the parenchyma, especially in the peripheral region, where they project everywhere over the surface.

Microscleres.

5. Plesiaster. The spicule has a short, usually somewhat curved, axis with 2 or 3 rays at each end, and sometimes with a ray or two projecting from the axis. Forms with 4, 5, and 6 rays are all common, although the 4-rayed form is the predominant type. The rays are most minutely roughened, scarcely spinose. Rays commonly 35–60 μ long with basal thickness of 5–6 μ. Smaller forms with ray length down to 20 μ occur. The plesiaster is very abundantly scattered throughout the parenchyma.

Sollas for the "Challenger" specimens (Sollas, 1888, p. 72) gives the plesiaster rays as 60–90 μ long x 3.9 μ thick. The rays in the specimens studied are thicker and shorter.

6. Spiraster. The spicule varies toward the metaster condition. The common forms are shown in Plate **13**, Fig. 3 *a–e*, among which 3 *b* and 3 *c* approach the metaster type more closely than do the others.——The axis is smooth and cylindrical, varies in length so as to exhibit in projection one or two concavities on the same side; sometimes bent rather than curved. The rays are tapering, most minutely roughened, and minutely tylote. Total length of the spicule, 32–48 μ; ray length, 10–20 μ. Sizes close to a total length of 40 μ with ray length of 14 μ, predominate. The spicule is abundant in the parenchyma, dermal membrane, and especially abundant in the membranes of the pore areas.

Sollas for the "Challenger" specimens gives total length of spiraster 39.5–47.4 μ, ray length, 12–19 μ. The spicules figured by Sollas (1888, Plate VIII., Figs. 7 and 8) might properly be designated metasters or amphiasters, although Sollas says metasters are absent.

Thenea fenestrata has hitherto only been recorded from the Atlantic Ocean and Caribbean Sea. Schmidt's specimens were taken in Lat. 24° 36′ N., Long. 80° 5′ W., at a depth of 955 fathoms; off Bequia at depths of 1507 and 1591 fathoms. The "Challenger" specimens were taken in Lat. 1° 47′ N., Long. 24° 26′ W., at a depth of 1850 fathoms; Lat. 10° 9′ S., Long. 35° 11′ W., at a depth of 1715 fathoms.

Thenea echinata, sp. nov.

Plate 12, Figs. 1-9.

Diagnosis. Body flattened but thick, and with a rounded polygonal outline. Round the periphery are several separate pore areas. An oscular depression near the centre of the upper surface. Upper surface densely covered with radial oxeas, projecting 5 mm. Under surface bears only small, short, projecting oxeas. Roots evenly scattered over the under surface. *Megascleres:* dichotriaenes, protriaenes, anatriaenes, oxeas. *Microscleres:* spirasters; total length, 28–40 μ; ray length, 10–14 μ.

Station 3415, 3 specimens.

The body (Figs. 1, 9, Plate **12**) is flattened, of a rounded polygonal outline, and bears a number of peripheral pore-areas. About in the centre of the upper surface is a smooth whitish (collenchymatous) oscular depression, into which open a number of efferent canals. This depression is nearly round in one specimen, irregular in the others, and is without, or with only a very indistinctly developed special spicular fringe. The upper surface is densely covered with radially arranged long oxeas, projecting about 5.0 mm. beyond the surface, and holding much sediment. The under surface is covered with radially arranged small oxeas, projecting about 1.0 mm. Round the margin of the sponge the long spicules of the upper and the short spicules of the under surface intergrade. Evenly scattered over the under surface, which appears smooth as compared with the upper, are roots 1–2 mm. thick, and 6–10 mm. apart, which are broken off close to the body. The color of the interior and surface is brown, except where the whitish collenchyma shows, the upper surface appearing dark because of the mud held by the surface covering of spicules. The horizontal diameter of the specimens varies from 40 to 60 mm., the vertical diameter including the projecting spicules from 20 to 25 mm.

The pore areas vary in number from 4 to 7, are mostly elongated in the horizontal plane of the sponge, but in some cases are nearly circular. The height of the areas varies from 5 to 9 mm., the width from 5 to 25 mm. They are depressed, and show the usual tumid whitish border. In some areas the upper margin is provided with a well-developed fringe of spicules, projecting about 5 mm. In other areas the fringe is absent, unless, indeed, it be thrown back and merged in the general spicular covering of the upper surface. The under margin of the areas in general lacks a special spicular fringe, but here and there such a structure reaches a feeble state of development. —— The pores, 85–340 μ in diameter, are mostly open, and the pore membrane appears as a coarse reticulum (Fig. 9, Plate **12**). But in some cases the pores are partially or completely closed, the membrane appearing nearly or quite imperforate. In the latter condition it is white and opaque. The pore membrane closes in a subdermal space, from which large canals pass into the interior.

The ectosome is collenchymatous, and about 0.5 mm. thick. The body in general is excavated by numerous canals of comparatively large size. The collenchyma round the larger canals is scanty. The flagellated chambers are eurypylous and large; many spheroidal, and about 70 μ in diameter; others more or less compressed, often strongly so, and measuring about 80 μ x 40 μ (artefact?). In sections fine canals (Fig. 2, Plate **12**) may here and there be seen extending radially through the ectosome and opening on the surface by single apertures.

Megascleres.

1. Dichotriaene, Figs. 2, 7, Plate **12**. The rhabdome is 100 μ thick just below the cladome, tapering evenly to the point, often somewhat curved, and about 6 mm. long. The protocladus is straight, tapers centrifugally, and measures about 140 μ x 85 μ. The deuterocladi are in general curved, first out, then in, as in Fig. 7, Plate **12**, taper evenly to the point, and measure about 960 μ x 70 μ.

The deuterocladi may exhibit a simple outward curvature. The deuterocladi are not always equal. In the same spicule some may be long and curved, others much shorter and about straight. The dichotriaenes are pretty closely set over the general surface, the cladomes overlapping.

The dichotriaenes bordering the pore areas, both above and below, are crowded, and many have smaller cladomes than the spicules elsewhere, the deuterocladi being comparatively short and straight. Some spicules exhibit a marked modification toward the protriaene condition, the protocladi projecting strongly upward, while the deuterocladi are very short, Fig. 5, Plate **12**.

2. Protriaene, Fig. 4, Plate **12**. Among the modified dichotriaenes which are found round the pore areas, perfect protriaenes occasionally occur. In such spicules the cladi make an angle of 45° with the rhabdome prolonged, and measure about 0.5 mm. by 70 μ.

3. Anatriaene, Fig. 8, Plate **12**. The spicules must be very rare, since only two were found in a large number of preparations. These were both somal, and were alike in shape and similarly placed; both broken.——The spicules project from the surface of the body, along with the oxeas. The rhabdome is about cylindrical, slender, 12 μ thick in its upper part. The cladome is deep; cladi about 200 μ x 12 μ, nearly straight, and tapering evenly to a point.

4. Oxea. a. Long, slender, nearly cylindrical oxeas, 6–7 mm. by 24–40 μ, project in closely set, diverging bundles over the upper surface (Fig. 2, Plate **12**). The arrangement in bundles is not well marked in some places, the spicules in such places being more diffusely scattered.

b. Much smaller, but similar oxeas, averaging 1400 μ by 10 μ, project in large numbers from the upper surface, between the basal parts of the larger spicules. Similar oxeas project in large numbers over the lower surface.

c. The oxeas of the parenchyma are chiefly arranged, along with the triaene rhabdomes, to form radiating somal bundles, Fig. 2, Plate **12**, but are also scattered. They are mostly long forms, varying from a slender, nearly cylindrical shape, 6–7 mm. x 20–30 μ, to a stouter, more fusiform shape, 6–7 mm. x 90 μ. Shorter, slenderer forms occur, but not abundantly, ranging down to 1.0 mm. x 10 μ.

d. The oxeas of the roots are as a class very long. Slender, nearly cylindrical forms, about 10 mm. x 30 μ, and stouter, more fusiform spicules, 10 mm. x 90 μ, are both common.

5. A number of very slender, nearly cylindrical spicules, clavate at one end, as shown in Fig. 6, Plate **12**, occur in the roots. The spicule just below the clavate end is 16 μ thick, narrowing then to 12 μ, then very gradually increasing in diameter for a length of 6 or 7 mm. to a thickness of 24 μ, at about which point all the spicules observed were broken across.

Microscleres.

6. Spirasters, Fig. 3, *a*, *b*, *c*, Plate **12**. Spirasters are abundant, but not crowded, throughout the parenchyma and ectosome, including the general dermal membrane, and thickly scattered in the pore membranes. There are no constant differences between the spicules of the several regions. Total length of the spicule, 28–40 μ; ray length, 10–14 μ. The larger sizes are more common in the parenchyma and ectosome than in the pore membranes.

The spiral axis is smooth, and varies in length, so as to exhibit in projection one or two concavities on the same side. The axis in different spicules varies in thickness. In some it is slender, 2 μ thick, and seems to be cylindrical in shape. Very commonly the axis is flattened and band-like, hence appearing wider in one part of the spicule than elsewhere (Fig. 3 *c*, Plate **12**), reaching in such parts a width of 4–5 μ.—— The rays appear rather long and slender, are minutely roughened and minutely capitate, tapering, numerous, and closely set.

A number of deviations from the type are met with, represented by a few spicules found here and there. Among these a form approaching the amphiaster occurs, consisting of a straight bar, at each end of which rays are clustered in a spiral curve.—— Spirasters also occur, in which the rays are longer, fewer in number, and less closely set along the axis than in the type. Such a spicule had a total length of 40 μ; rays 12 in number and 16 μ long.

Thenea lamelliformis, sp. nov.

Plate 12, Figs. 10-13; Plate 13, Fig. 1.

Diagnosis. Body a comparatively thin plate, irregularly polygonal in outline. Both surfaces hispid, with small oxeas projecting about 1.0 mm.; these abundant in places, scanty elsewhere. A number of marginal pore areas. Oscula scattered over upper surface. Slender rootlets scattered over under surface. *Megascleres:* dichotriaenes, anatriaenes, oxeas. *Microscleres:* spirasters; total length, 30–40 μ; ray length, 12–16 μ.

Station 3414, 2 specimens.

The body (Fig. 13, Plate **12**) is a comparatively thin plate, the habitus resembling that of *Thenea wrightii* Sollas (Sollas, 1888, p. 63, Plate VIII., Figs. 11–20). The outline of the plate is irregularly polygonal, and round the margin are a number of separate pore areas, — in the larger specimen eleven. Over the upper surface are scattered several — in the larger specimen eight — oscula, the openings of depressions into which debouch several efferent canals. The oscula have the usual white, tumid wall, and lack a spicular fringe. Some of them are nearly closed, appearing small and slit-like; others widely open, 5 mm. in diameter. The upper surface is comparatively flat, but the under surface is more uneven, and bears, scattered over it, a number of very slender rootlets. The rootlets are broken off short of the ends, but some measure 20 mm. in length; diameter at the base, 0.5 mm., the rootlet tapering toward the extremity. The body of the sponge measures 7–8 mm. in thickness, thinning away toward the edge, which is pretty sharp. The larger specimen has a greatest width of 72 mm.

The color is gray. The surface, wherever clean, looks somewhat gelatinous and translucent. It is hispid, with small oxeas, projecting for the most part not over 1.0 mm., but with these are intermingled here and there oxeas projecting 3–4 mm.

Between some of the pore areas the margin of the body is indented, the portions bearing the areas projecting and appearing as vaguely indicated marginal lobes (comp. Sollas, 1888, p. 63). The pore areas themselves are depressed, short in the vertical axis of the body, elongated in the horizontal plane, measuring in the latter direction 10–15 mm. There is every evidence that the margins of the areas are highly contractile (Vosmaer, 1882, p. 8). The margins are white, tumid, and in general without a spicular fringe. Nevertheless, in the case of some areas, a feebly developed fringe is present over a part of the lower edge, projecting 3–5 mm., and a dense flattened tuft of spicules projects from the upper edge of one of the areas. The pores are mostly open, measuring up to 300 μ in diameter. In some areas the pores are closed, the membrane at the bottom of the area then appearing not as a reticulum, but imperforate, white, and opaque. The subdermal cavity, roofed in by a pore membrane, connects directly with large canals passing into the interior.

The flagellated chambers appear in the sections flattened and about 80 μ x 40 μ, or spheroidal and 50–60 μ in diameter. I incline to think that the chambers naturally vary a good deal in size.—Large canals are rather numerous in the body of the sponge. In the superficial region the arrangement of the sponge tissue is distinctly lamellate, the lamellae extending more or less parallel to the surface of the sponge, with flattened lacunar spaces between. This arrangement is confined to the superficial part of the body, but is found at both surfaces.

Megascleres.

1. Dichotriaene; rhabdome straight and evenly tapering to a point, about 5 mm. x 85 μ; protocladus projecting slightly upward, tapering very slightly, 220 μ x 60 μ; deuterocladus also projecting slightly upward, tapering evenly to a point, straight or slightly curved, 750 μ long.

At the upper surface of the body the dichotriaenes are abundant; less abundant at the lower surface. In both regions the rhabdomes are set obliquely to the surface, not radially. In very many cases the inclination is so oblique that the rhabdome comes to occupy a nearly tangential position.

About the margin of the pore areas some of the dichotriaenes show the usual modification, the cladomes becoming smaller than elsewhere, the deuterocladi in many spicules being short and straight. Among these occur spicules resembling those figured for *Thenea echinata* (Plate **12**, Fig. 5), and which are obviously close to the protriaene condition. No perfect protriaenes were observed.

2. Anatriaenes. Somal anatriaenes, Figs. 10 and 12, Plate **12**, are fairly abundant in the smaller specimen, rare in the larger. Rhabdome, 4–5 mm. by 10–12 μ above, becoming very slender and hair-like; curved. Cladi, 100–204 μ long, nearly straight or slightly curved, tapering evenly; cladome deep.

The somal anatriaenes accompany the dichotriaenes of the obliquely radial bundles. The rhabdome of the anatriaene is coiled in a loose spiral round that of a dichotriaene, the cladome of the former lying just below the cladome of the latter.

Radical anatriaenes, Fig. 11, Plate **12**, occur in considerable number in the smaller specimen; none found in the larger specimen. Rhabdome always broken, 20 μ thick above; cladi, 85–250 μ long; cladome deep. The cladi and rhabdome are somewhat stouter than in the somal spicules. The cladi vary a good deal in curvature as well as in length. In some spicules they are markedly incurved as in the specimen figured, in others nearly straight or only very slightly curved. The spicules occur in the spicular core of the rootlets.

3. Oxea. a. The common large form measures 9 mm. x 50 μ to about one-half this size; median enlargement with axial cross sometimes present, especially in the smaller sizes; spicule tapering evenly to each end.—— The spicules are abundantly scattered in the parenchyma, where they cross at all angles, sometimes running side by side so as to form bundles of two or a few. They also accompany the rhabdomes of the dichotriaenes, aiding in the formation of the obliquely radial skeletal bundles. They are also found singly or in bundles of two or three, lying tangentially in the dermal membrane on both surfaces.

b. Very slender oxeas, 6 mm. x 12–15 μ to one-half this size, form part of the obliquely radial skeletal bundles. The spicule is cylindrical, tapering gradually at each end to a fine point, and is curved usually two or three times in a wave-like manner. These oxeas are twined round the larger spicules of the bundles.

Similar oxeas, reaching a greater length, 9 mm., occur in the rootlets, where together with the other longitudinally arranged spicules they form a sort of core.

c. Small oxeas about 1 mm. x 10 μ project from both upper and lower surfaces in considerable number, forming in places a pretty thick furze. The spicules project obliquely or about radially. A few similar spicules occur scattered in the parenchyma. Others lie tangentially in the dermal membrane.

Microscleres.

4. Spirasters, Figs. 1 *a–e,* Plate **13**; abundant in the dermal membrane, pore membranes, and choanosome; somewhat less abundant in the ectosome; spicules of the several regions not distinguishable.

The smooth spiral axis exhibits in projection one or two concavities on same side. Axis sometimes appears cylindrical, more often is flattened and band-like. Rays are minutely roughened, minutely tylote, numerous and closely set along the axis. Total length of spicule, 30–40 μ; ray length, 12–16 μ.

Forms occur with fewer and longer rays than the typical spicules. In such forms noticeable gaps are left along the axis between the bases of the rays. The rays may become conspicuously few and long, as in the spicule shown in Fig. 1 *e*, Plate **13**, where the ray length is 18–20 μ, and the total length 44 μ.

The spirasters with few rays pass into metasters of an amphiaster character, the spicule bearing a few rays at each end of the axis and one or two rays at about the middle of the axis. Such spicules are infrequent.

The spirasters of this species closely resemble those of *Thenea echinata.*

Thenea pyriformis, sp. nov.

Plate 13, Figs. 5, 8, 10, 11.

Diagnosis. Body pyriform, with a ring of inconspicuous marginal pore areas. On the upper surface, a shallow oscular depression. Under surface bears numerous small conulose eminences, which point downward. Surface in general feebly hispid. *Megascleres:* Dichotriaenes, protriaenes, anatriaenes, oxeas. *Microscleres:* Plesiasters; rays, 40–60 μ x 4–5 μ. Metasters of varying shape; axis in the characteristic forms short and thick; spicule length, 28–30 μ; ray length, 10–12 μ.

Station 3414, 1 specimen.

The body is pyriform in shape (Fig. 5, Plate **13**), but compressed in one of the horizontal axes; 27 mm. high, 23 mm. wide in one horizontal axis and 15 mm. wide in the other. There is an irregular ring of separate pore areas, five in number, nearer the upper larger end of the body, but not all at the same level. The upper surface bears a single wide and very shallow oscular depression (Fig. 8, Plate **13**), which is somewhat excentrically placed. This depression appears as a smooth collenchymatous area, which includes the apertures of several efferent canals, and which is without a special spicular fringe except at one point, where the elsewhere indistinct margin forms a projection from which some spicules extend obliquely 2–4 mm. over the oscular area.

The color is gray. The upper surface is comparatively even, but below the level of the pore areas there are numerous rather vaguely marked conulose eminences pointing downward. The surface in general is feebly hispid with small oxeas, projecting obliquely for the most part about 1 mm., but over the lower part of the sponge the projecting spicules, pointing downward, are more abundant and are longer, reaching commonly a length of 3 to 4 mm. A few compact bundles of spicules, scattered over the lower surface, broken off close to the body, and measuring less than 0.5 mm. in diameter, probably represent rootlets.

The pore areas in general are indistinct, owing in part to the fact that they lack a clearly defined lower boundary, and in part because the margin scarcely differs in color and appearance from the rest of the sponge surface. The upper margin of the areas nevertheless forms a distinct ridge, which in some cases is drawn down so as to project obliquely over the area. There is no spicular fringe. The pore membrane lining the area presents the usual reticular appearance, except where the pores are closed. The pores themselves measure up to 180 μ in diameter.

The body of the sponge is not excavated by large canals, and is accordingly comparatively dense. Flagellated chambers measure about 40 x 30 μ in diameter.

Megascleres.

1. Dichotriaene; rhabdome, straight, tapering evenly, 5 mm. x 80 μ; protocladus, 280 μ x 70 μ, tapering distad very slightly; deuterocladus, 800 μ x 50 μ, tapering evenly and curved outward, then inward in the fashion so common in species of Thenea.

In the neighborhood of the pore areas, the dichotriaenes show the usual modification, the cladomes becoming smaller, the deuterocladi especially short and about straight.

2. Protriaene. Among the modified dichotriaenes round the pore areas a few perfect protriaenes, resembling the spicule shown in Fig. 6, Plate **13**, occur.

3. Anatriaene. Only a single spicule was found. It was a somal anatriaene resembling the smaller radical forms of *Thenea lamelliformis.*

4. Oxea. The very numerous oxeas fall into three classes which intergrade. Types of the three classes measure respectively 8 mm. x 70 μ, 8 mm. x 17 μ, 1.25 mm. x 20 μ.

5. *Oxytylotes* are occasionally met with. Their shape and size indicate that they are derived from the long stout variety of oxea.

Microscleres.

6. *Plesiaster*, Figs. 10 *b*, 10 *d*, Plate **13**. The spicule is very abundant in the parenchyma; rays commonly 4 or 5 in number, 40–60 μ by 4–5 μ, minutely roughened and tapering evenly to points; centrum and neighboring parts of rays smooth. Triactine, diactine, and monactine forms occasionally occur.

Smaller sizes with more numerous rays (Fig. 10 *e*, Plate **13**) occur intermingled with the larger characteristic forms. In these spicules, which offer a transition to the metasters, the rays measure about 20 μ x 2 μ.

7. *Metasters* are abundant in the general dermal membrane and in the pore membranes, and occur scantily in the parenchyma. The rays taper to points and are most minutely roughened, while the axis is smooth. The spicules differ among themselves a good deal, and fall into three groups which intergrade.

a. Typical metasters, Figs. 10 *c*, 10 *f*, 11 *a*, 11 *d*, Plate **13**, are fairly common. The rays may be numerous, as in 11 *a*, or few, as in 11 *d*. Total length of the spicule, 30–38 μ; rays, 12–14 μ x 2 μ.

b. The predominant type of metaster is one in which the axis is very thick and short (Figs. 10 *a*, 11 *c*, 11 *e*, Plate **13**). The rays may be few (Fig. 11 *e*) or many in number (Fig. 11 *c*). Spicule length, 28–30 μ; ray length, 10–12 μ.

c. The axis of the metaster may be greatly shortened, approaching the condition of a centrum (Figs. 11 *b*, 11 *f*, 11 *g*). Such spicules may be designated metaster-oxyasters. The ray length is about 8 μ.

Vosmaer (1902, p. 3) argues against the existence of transitional forms between spirasters and true asters (euasters). It seems to me nevertheless that the spicules here described may properly be considered as transitional forms between metasters and oxyasters, even if (this appeared not to be the case) such images as are represented in Figs. 11 *f* and 11 *g* are only *end-views* of spicules like 11 *b*.

d. The metaster is, rarely, found varying toward the amphiaster, as in Fig. 10 *g*, Plate **13**. The spicule may conveniently be designated metaster-amphiaster. It has a few rays at each end, and one or two rays on the axis. Spicule length, about 40 μ; ray length, about 18 μ.

Poecillastra Sollas.

1888. *Poecillastra* Sollas, 1888, p. 79.
1894. *Poecillastra* Sollas, Topsent, 1894, p. 383.
1894. *Pachastrella pars* Lendenfeld, 1894, p. 94.
1902. *Poecillastra* Sollas, Topsent, 1902, p. 10.
1903. *Pachastrella* (*Pachastrella*) O. Schm. *pars* + *Pachastrella* (*Nethea*) *pars* + *Sphinctrella* O. Schm. *pars* Lendenfeld, 1903, pp. 70, 73, 78.

Poecillastra tricornis, sp. nov.

Plate 13, Figs. 12-14; Plate 14, Figs. 1-8.

Diagnosis. Body plate-like. One surface somewhat convex, and bearing the pores. Opposite surface somewhat concave, and bearing the oscula. Main afferent and efferent canals similar; numerous and small; radial to corresponding surface; of the uniporal type, the aperture of the canal (pore or osculum) lying in the centre of a circular membranous area, and provided with a strong chone-like sphincter. *Megascleres.* Oxea. Triaene, with degenerate rhabdome (triod), chiefly ectosomal, but also in the interior. *Microscleres.* Microxea, annulated, 400–500 μ long. Microxea, nearly smooth, 120 μ long. Spiraster, dermal; spicule length, 20 μ; rays, 2–3 μ long. Metaster and spiraster, parenchymal; intergrading and very similar; spicule length, 20–26 μ; rays, 7–8 μ long.

Station 3404, one large specimen and two fragments.

The larger specimen is a plate 100 mm. wide, and in general 5 mm. thick, Fig. 8, Plate **14**. The free edge of the sponge describes about a semicircle. Along the remaining part of its periphery the plate has been broken across, probably not far from the line of attachment. In this region the plate is thicker than elsewhere, attaining a thickness of 10 mm. The plate is not quite flat, but is slightly folded, so as to produce wide, shallow depressions on both surfaces. One surface, designated the oscular surface, is throughout the peripheral region slightly concave, meeting the free margin of the sponge along a sharp boundary line. The opposite surface, designated the pore surface, is throughout the peripheral region slightly convex, and is evenly rounded off at the margin.

The color is whitish-brown, the consistency firm, the surface almost hard. Both surfaces of the sponge are smooth, save for a few scattered oxeas, which project radially or obliquely 2 to 20 mm. On both surfaces, beneath the dermal membrane, the tangentially placed spicules supporting it are partially visible.

The two surfaces of the sponge are much alike, both exhibiting, scattered evenly over the whole face, circular shallow depressions, each of which is lined by a smooth membrane pierced in the centre by a single aperture of varying diameter. The depressions on the oscular face (Figs. 6 and 8, Plate **14**) are 500–700 μ in diameter, and 1.0 to 1.5 mm. apart. The depressions on the pore face (Fig. 5, Plate **14**) are somewhat larger and farther apart than on the oscular face, measuring commonly 700–900 μ in diameter, and lying about 2 to 3 mm. apart, but are not so deep, being in places exceedingly shallow. The membranes lining the depressions on the oscular face are the oscular membranes, the apertures themselves, which are in various stages of contraction, representing the oscula. The membranes lining the depressions on the opposite face are the pore membranes, the apertures, which are likewise in various stages of contraction, representing the pores.

The main afferent and efferent canals are essentially alike. They have a diameter of 500–700 μ, and pass about vertically into the interior from the corresponding surfaces, on which each is covered in by a pore or oscular membrane respectively. Sections vertical to the oscular surface of the sponge, and passing longitudinally through the efferent canals, are shown in Figs. 3 and 7, Plate **14**. A section vertical to the pore surface, and passing through an afferent canal, is shown in Fig. 4, Plate **14**. A part of the oscular surface, showing three oscular membranes, is represented in Fig. 6, Plate **14**, and a part of the pore surface, including a pore area, in Fig. 5, Plate **14**.

The walls of the main afferent and efferent canals are collenchymatous, and exhibit numerous transverse circular ridges. These often project, especially in the neighborhood of the sponge surfaces, a considerable distance into the lumen of the canal, appearing as septa perforated by round apertures. Similar incomplete septa often separate the lateral branches from the main canal. The aperture in the septum may sometimes be very small, as shown in the lower half of Fig. 4, Plate **14**. In the neighborhood of such small apertures débris consisting largely of shells of Foraminifera is sometimes found collected. It may well be asked how heavy bodies of this kind are moved through sponge canals. The appearance of the internal septa suggests that in them as in the surface membranes the apertures may be closed and opened. Possibly the apertures open suddenly, and the contents are passed on from one chamber into another, either as a result of an existing difference of pressure on the two sides of the septum, or as a result brought about by simultaneous contraction of the canal wall.

The oscular membranes are distinctly outlined. They contain spirasters, and are without or with only a few scattered microxeas, while the dermal membrane in general is densely filled with microxeas. The majority of the oscula are closed or nearly closed, the membranes exhibiting near the centre a rounded patch which appears dark with transmitted light, and which sometimes includes a minute aperture (Fig. 6, Plate **14**). In radial sections through closed canals (Fig. 7, Plate **14**) it is seen that the oscular membrane is produced inward into a plug-like process which is marked by a dense axial streak of spirasters. The plug of course corresponds to the dark patch in the surface view of the membrane. The appearances indicate that the oscula are provided with strong sphincters, the contraction of which closes the osculum and produces the plug-like projection.——The pore membranes and pores (Figs. 4, 5, Plate **14**) are essentially like the oscular membranes and oscula.

Collenchyma is abundant throughout the sponge, and contains many granular cells with fine processes. It is, moreover, transversed by abundant fine fibres, which branch and anastomose (Fig. 1, Plate **14**).

The ectosome is collenchymatous, and distinctly developed, although it varies in thickness. Measured between the vertical canals, it is 350–400 μ thick at the pore surface, 510 μ thick at the periphery of the sponge 800 μ to 1.0 mm. thick at the oscular surface.

The flagellated chambers are eurypylous and about 50 μ wide. The chambers (Fig. 1, Plate **14**) show the peculiar structure known as Sollas's membrane, described by Sollas (1888, pp. xxxvi–xxxvii) and Dendy (1888, pp. 18–21). The fenestrae in the membrane have for the most part sharp boundaries. Through some of them the nuclei and protoplasmic masses on the boundary membrane of the chamber may be seen. The collar cells are not well preserved, but fine strands may be traced running from the boundary membrane to Sollas's membrane. The distance between the boundary membrane and Sollas's membrane varies considerably, and possibly when the distance is great the two membranes are not in their natural positions.

Megascleres.

1. Oxea. a. Smooth, slightly curved, or bent spicule, tapering at each end, 2.5 mm. x 85 μ to 5 mm. x 135 μ. Spicule is abundantly scattered through the parenchyma; also abundant just beneath the dermal membrane on both oscular and pore faces, here lying tangentially and together with the tangential rays of the triaenes supporting the dermal membrane.

b. Larger oxeas of the same character as above, reaching 25 mm. in length, project in rather small number from both surfaces.

c. Rhaphid oxea, smooth, cylindrical, 3–5 mm. x 12 μ; not very abundant; disposed without order in the interior, often but not always in bundles of two or three.

2. Triaene. Rhabdome, except in rare cases, reduced to a rounded knob (Fig. 13, Plate **13**), the spicule becoming a triod; exceptionally appearing as an elongated pointed ray, shorter than, or about the length of, the cladi. Cladi 1.0 mm. to 700 μ long, smooth, tapering to a point, and curving slightly in the direction of the reduced ray. The three cladi are usually but not always of about the same length, and are frequently slightly twisted or deformed.

The triaenes are very abundant just internal to the dermal membrane at both surfaces; here arranged in several layers (about three), with the cladi tangential to the surface. The cladi of adjoining spicules overlap, and together with the tangentially placed oxeas, they establish a hypodermal framework.——The same triaene is also scattered sparsely through the interior along with the internal oxeas, becoming fairly abundant near the margin of the sponge body. In the interior the cladi are not arranged tangentially to the surface, but at various angles.

Microscleres.

3. Annulated microxea, Fig. 12, Plate **13**. Spicule, 400–500 μ x 8–16 μ, curved, and tapering at each end. Surface covered with minute annular ridges, which give the impression of being parts of a discontinuous spiral ridge. At the ends, the ridges give place to a mere granulation of the surface. Very abundant in the hypodermal region at both surfaces, and here for the most part tangentially placed. Fairly abundant in the interior, and here disposed without order.

4. Microxea, Fig. 14, Plate **13**. Spicule commonly about 120 μ long, slightly curved, tapering at each end. Surface nearly but not quite smooth, most minutely roughened. Abundant in the interior and in the hypodermal region. Possibly only a young form of the annulated oxea.

5. Spirasters of dermal membrane, Fig. 2 *a*, Plate **14**. Spicule length, 20 μ; rays, 2–3 μ long, numerous, blunt-pointed. Whole spicule smooth.

Spiral axis shows in projection two or three concavities on the same side. Very abundant in the dermal membrane of both surfaces.

6. *Metasters* of parenchyma, Fig. 2 *c*, Plate **14**. Spicule length, 20 μ; rays, 7 μ, tapering to points, pretty closely set along the curved axis. Whole spicule smooth. Abundant throughout the parenchyma. Spicules pass through transitional forms into the very similar spirasters of the parenchyma.

7. *Spirasters* of parenchyma, Figs. 2 *b*, 2 *d*, Plate **14**. Spicule length, 24–26 μ; ray length, 8 μ. Spicule resembles the metaster, with which it intergrades, but both axis and rays are longer, and the rays less closely set along the axis. Abundant in the parenchyma.

Poecillastra cribraria, sp. nov.

Plate 14, Figs. 9-12; Plate 15, Figs. 1-4; Plate 16, Figs 1, 3.

Diagnosis. Body, plate-like. One surface slightly convex and bearing the pores. Opposite surface slightly concave and bearing the oscula. Main afferent and efferent canals similar; numerous and small; radial to the corresponding surface. Pores thickly and uniformly scattered; appearing to the eye to be localized in areas. Oscula, 70–200 μ in diameter, occurring singly or in small groups as perforations of the membrane roofing in a main canal. *Megascleres.* Oxea. Triaene, ectosomal, and with a rhabdome shorter than the cladi. *Microscleres.* Microxea, 180 μ long, surface minutely roughened. Spiraster, dermal; spicule length, 16 μ; rays, 2–3 μ long. Plesiaster and plesiaster-metaster, parenchymal; spicule length, 24 μ; rays, 12 μ long.

Station 3405, 1 specimen.

The specimen, Fig. 3, Plate **16**, is a fragment from the peripheral part of a plate-like sponge. The pore surface is slightly convex, and is evenly rounded off at the free margin of the sponge. The oscular surface is slightly concave, and meets the free margin along a sharp line. The two nearly straight edges in the specimen are broken edges, the curved edge representing the natural margin of the sponge. The fragment measures 40 x 25 mm., and is 5 to 9 mm. thick. The color is light brown. The sponge is firm but not hard, with both surfaces smooth though not strictly even.

The main afferent and efferent canals are very similar. They pass radially into the body from the corresponding surfaces, are 1.5 to 2.0 mm. apart, and have a diameter of 600 μ to 1.0 mm. Beneath the dermal membrane on both surfaces, between the larger canals, are everywhere abundant smaller spaces.

The entire dermal membrane of the pore surface (Fig. 4, Plate **15**) is riddled with the fairly evenly distributed pores, which have a diameter of about 75 μ. But the pores immediately over the ends of the larger canals form areas conspicuous to the eye, and thus, when the whole sponge is examined from the surface, the pores appear to have a localized distribution in small rounded or irregularly shaped areas.—— Some of the main afferent canals are formed by the confluence of small, elongated, tubular subdermal spaces.

On the oscular surface (Fig. 3, Plate **15**; Fig. 3, Plate **16**), the efferent canals are closed in by oscular membranes, which are commonly perforated by groups of small oscula up to about 10 in number. The groups are of irregular shape, and vaguely outlined, although conspicuous to the eye. With a lens it may be seen that many of them are branched, the arrangement indicating that the efferent canals themselves sometimes extend out beneath the surface in tangentially spreading branches. In the case of other canals the oscular membranes roofing them in are perforated by single similar apertures or by small groups of two and three. The individual oscula, whether arranged singly or in groups, have a diameter of 70 to 200 μ.

The oscular membranes are very thin, and in the immediate neighborhood of the apertures contain only spirasters and sparsely scattered microxeas. Between the apertures of a group the microxeas are more abundant, and occasionally a megasclere extends into or through the membrane of an oscular area.——Between the separate oscula or groups of oscula which are visible to the eye, the dermal membrane, Fig. 3, Plate **15**, is studded with thin rounded areas 50–75 μ in diameter, representing the roofs of small spaces everywhere present beneath the membrane. These thin areas contain spirasters and sparse microxeas, and are frequently perforated. Thus the plan of the canal apertures on the oscular face is much like that on the pore face.

The choanosome, which looks rather dense to the eye, is permeated by abundant small canals, which reduce it to thin trabeculae. Collenchyma is scanty. The ectosome is thin and feebly marked; differentiated from the choanosome only by its pores and skeleton, and by the absence of flagellated chambers.

The choanosome contains an abundance of deeply staining cells similar to those described by Sollas (1888, p. 81) for *Poecillastra schulzei*. The cell body (Fig. 1, Plate **15**; Fig. 1, Plate **16**), which is spheroidal, oval, or rounded polygonal is about 20 μ in diameter, and is filled with closely packed spheres 3–4 μ in diameter. A nucleus can sometimes be made out. The cells are identical with some of the "cellules sphéruleuses" described by Topsent (1894, p. 284; Fig. 18 *s*, Plate XVI.).

The flagellated chambers (Fig. 1, Plate **16**) are eurypylous, opening by wide apertures into the efferent canals. The basal membrane on which the collar cells rest is perforated by several chamber pores, which place the set of spaces lying between the collar cells in communication with an afferent canal (Fig. 1, Plate **16**). The basal membrane in surface view (Fig. 2, Plate **15**) appears as a thin, finely granular membrane, which shows no cell boundaries. On it rest the cell bodies of the collar cells, appearing as angular masses each enclosing its nucleus.——The preservation is good, and the chambers show Sollas's membrane. This membrane (Fig. 1, Plate **16**) is distinctly fenestrated, and has an appearance suggesting a firm, dense structure. The collar cells appear as shown in the figure. The expanded lower part of the cell is granular, and contains the nucleus. Above, it is prolonged into a transparent homogeneous process, which at first is double-contoured, then for a short distance single-contoured, expanding and becoming double-contoured again where it passes into Sollas's membrane. In the case of some cells it may be seen that this process (doubtless the collapsed collar) passes into Sollas's membrane in such a way as to bound one of the fenestrae. I am thus able to confirm Sollas's observations (1888, pp. xxxvi–xxxvii), and may add that while the appearance of the chambers may not be entirely normal, it seems improbable that Sollas's membrane is an artefact.

The chambers vary a good deal in size, but are often 40–50 μ wide; frequently strongly flattened, the actual cavity of the chamber becoming shallow. The wall of the chamber, from the basal membrane to Sollas's membrane, is noticeably thick.

Megascleres.

1. Oxea. *a.* Fairly stout form, about 2.5 mm. x 40 μ; smooth, tapering at each end; commonly slightly curved or bent at the middle, sometimes nearly straight. Abundant in choanosome; here scattered in all directions, usually singly, but also in loose tracts of two or three. In the superficial region many oxeas are arranged radially or obliquely, often projecting slightly (Fig. 1, Plate **15**). Tangentially placed oxeas occur in considerable number beneath the dermal membrane of the oscular surface, and in small number beneath that of the pore surface.

b. Rhaphid form, about 3.5 mm. x 10 μ; smooth, nearly cylindrical, though tapering at the ends; slightly curved. Much less abundant than the stouter form, with which the spicule occurs intermingled.

2. Triaene, Fig. 10, Plate **14**. Rhabdome about 200 μ x 30 μ, straight, smooth, pointed. Cladi about 380 μ x 30 μ, slightly arched outward, smooth, tapering to points. Lying in the ectosome, the cladi extending tangentially beneath the dermal membrane. The spicules are only sparsely present at the pore surface; more abundant at the oscular surface, in places quite abundant, although forming only a single layer; most abundant round the free edge of the sponge, where the cladi may form in spots two or three layers.——Triaenes (Fig. 9, Plate **14**) are occasionally found in which one or two of the cladi are forked (imperfect dichotriaenes). Or one of the cladi is bent as if only one of the deuterocladi had developed. Such a spicule is shown in Fig. 3, Plate **15**.——In a large number of preparations, I found only a single triaene, and that, like those at the surface, in the interior of the sponge.

Microscleres.

3. Microxea, Fig. 11, Plate **14**. Spicule about 180 μ x 4 μ, slightly curved and tapering gradually toward each end; surface minutely roughened. The spicule may be symmetrically curved, or the curvature may be slightly irregular. Exceedingly abundant in the ectosome, and here chiefly tangential; also very abundant in the trabeculae of the choanosome.

4. Spiraster, Fig. 12 *a*, Plate **14**. Spiral axis showing in projection two or three concavities on the same side. Spicule length, 16 μ; rays, 2–3 μ and tapering to sharp points. Very abundant in the dermal membrane of both surfaces.

5. Plesiaster (Fig. 12 *b*, Plate **14**) and *plesiaster-metaster* (Figs. 12 *c*, 12 *d*, Plate **14**). Spicule length, 24 μ; rays straight, smooth, slender, tapering to points, 12 μ long. Axis smooth and short. The forms in which the axis bears only rays at the ends are designated plesiasters; number of rays commonly 5. When the axis bears rays at its ends, and one or two along its course, the spicule is designated a plesiaster-metaster; number of rays commonly 6–7. The two varieties are intermingled, and are abundant though not crowded throughout the choanosome.

Now and then spicules are found with shorter and more numerous rays and longer axis, the spicule representing a fairly typical metaster. In a representative spicule of this kind the axis was strongly curved; the rays, nine in number, 6–8 μ long.

Poecillastra cribraria stands close to *P. schulzei*, Sollas (1888, p. 79), the type specimens of which I have examined. The arrangement of pores and oscula is very similar in the two forms.

Note. The genus *Poecillastra* was created by Sollas (1888, p. 79) for certain plate-like sponges collected by the "Challenger." The preservation of these sponges was so good that Sollas was able to study their anatomy, and in consequence to define his genus in an unusually satisfactory manner. The characteristics of the new forms (*P. schulzei, P. crassiuscula, P. laminaris, P. tenuilaminaris*) were the following: The body is plate-like. On one surface are the pores, either evenly distributed or in closely set areas. On the other surface are the oscula, small and evenly dispersed. The main afferent and efferent canals are small, very numerous, and their openings are thickly distributed over the corresponding surfaces. Specialized pore areas, as in *Thenea*, and specialized oscular areas, as in *Sphinctrella*, are not present. The flagellated chambers are eurypylous. The megascleres are oxeas and tetraxons, the latter represented by orthotriaenes and calthrops, the two forms being very similar. The triaenes are localized at the surface, the calthrops scattered through the interior. *Both triaenes and calthrops may be "comparatively rare"* (*P. crassiuscula*). In the triaenes and calthrops the actines may be "*frequently rounded off into short rods or tubercles*" (*P. tenuilaminaris*). The microscleres are microxeas, spirasters, and metasters varying to plesiasters.

The similarity of the two species described in this report to the four "Challenger" species of *Poecillastra* is very close, and it is obviously necessary to include them in the same genus, if we take into consideration the entire structure. In respect to a *single* point, viz. the degeneration of the rhabdome, *Poecillastra tricornis* resembles the sponges grouped by Sollas (1888) and Topsent (1902) under *Nethea.* This genus has been a very doubtful one. Sollas (1888) erected it for *Nethea* (*Tisiphonia*) *nana* Carter (1880). Topsent (1902) adds to it *Nethea* (*Pachastrella*) *amygdaloides* Carter (1876) and *Nethea* (*Pachastrella*) *connectens* O. Schm. 1870. In all three sponges the canal system is unknown, and in the last the skeleton is imperfectly known. It is possible therefore that the group is heterogeneous. The new definition given by Topsent (1902, pp. 10–11), however, strengthens the genus, which may be a useful one. Topsent characterizes it as having but one sort of streptaster, and that a spiraster, which definition excludes my form. Lendenfeld (1903) retains *Nethea* Sollas as a subgenus of *Pachastrella,* a genus which, as conceived by Lendenfeld, is heterogeneous, including as it does forms with eurypylous (*Poecillastra* Sollas) and forms with aphodal (*Pachastrella abyssi* Schm., Sollas, 1888, Plate XI.) chambers. According to Lendenfeld's classification my species, *Poecillastra tricornis,* owing to the degeneration of the tetraxon rhabdome, would be separated from the above-mentioned "Challenger" species of *Poecillastra,* and would be classed along with the certainly very different *Nethea nana* Carter. I cannot but regard this part of Lendenfeld's classification as artificial.

In the absence of tetraxons from the interior, *Poecillastra cribraria* agrees with *Characella* Sollas. But this is a negative point of resemblance, which cannot be used to exclude the species from *Poecillastra,* since the tetraxons are rare in one of the type species of the latter genus. If *Characella* Sollas is maintained at all, it must be based, as Topsent (1902) points out, on some other and positive characters. In Topsent's classification, the microscleres especially are made use of for this purpose, and *Characella* is re-defined as having microxeas and amphiasters, which effectually excludes my species.

In re-defining *Poecillastra,* Topsent (1902, p. 10) has altered the original diagnosis of Sollas so as to make the genus include forms in which the calthrops are absent from the interior: "Triaenes inégalement développés suivant les espèces, souvent rares, localisés à la périphérie *ou épars en outre à l'intérieur* où ils simulent des calthropses." I would adopt this emendation. The existence of *Poecillastra tricornis* makes it necessary to add to the definition the following clause: An actine of the tetraxon may degenerate, the spicule becoming characteristically in some species a triod. This qualification is really implied in Sollas's definition, since he includes under *Poecillastra, P.* (*Pachastrella*) *amygdaloides* Carter, the tetraxon of which is a triod.——Topsent's definition includes a clause which must be modified: "Des microxes *épineux* par tout le corps." The microxeas are "roughened or minutely spined or smooth" in one of the type species, "roughened" in another, and apparently smooth in the others, since a spinous surface is not mentioned.

STELLETIDAE Sollas.

Penares Gray.

1867. *Penares* Gray, 1867, p. 542.
1888. *Papyrula* O. Schm., Sollas, 1888, p. 198.
1891. *Penares* Gray, Vosmaer, 1891.
1894. *Ecionema pars* Lendenfeld, 1894, p. 97.
1894. *Penares* Gray, Topsent, 1894, p. 356.
1900. *Penares* Gray, Thiele, 1900, p. 21.
1903. *Ancorina* O. Schm. subgen. *Penares* Gray + *Papyrula* O. Schm., Lendenfeld, 1903, pp. 60, 69.

Penares foliaformis, sp. nov.

Plate 15, Figs. 5-11.

Diagnosis. Entire body probably massive, with curved surface. Oscula? Cladomes of the dichotriaenes divide the surface into pore areas, about 0.75 mm. in diameter. In each pore area usually a single pore, opening into a short radial pore canal, which connects with a subspheroidal subdermal chamber. Flagellated chambers aphodal. Ectosome collenchymatous, and containing many fibre cells arranged tangentially. *Megascleres.* Dichotriaenes, varying toward triaene condition, with flattened, irregular, leaf-like cladomes, form a single layer at the surface. Oxeas, singly and in loose sheaves, in parenchyma; for the most part more or less radially arranged. *Microscleres.* Microrhabds of oxeate character, but with rounded ends, 160 x 8 μ to 60 x 5 μ; very abundant in the superficial layer of the ectosome. Oxyasters, 16–24 μ in diameter, in canal wall and intervening parenchyma.

Station 3404, 1 specimen.

The single specimen is a small, well-preserved fragment (Fig. 7, Plate **15**), including the surface and part of the interior. The surface has a spheroidal curvature, and the fragment a greatest thickness of 9 mm. The surface is hard, stony, and whitish-brown; the interior dense, firm, and slightly darker in color. The piece includes no oscula, and the shape of the entire sponge is problematical, although probably massive, with curved surface.

To the eye, or with a lens, the surface appears divided into minute polygonal areas about 0.75 mm. in diameter. These are the pore areas, which have a whitish appearance in the alcoholic specimen. They are separated by narrow, darker-looking bands, which represent the reticulum formed by the tangential rays of the dichotriaenes. Minute dark points are visible scattered in the dark bands, and less distinctly in the whitish areas. In the former they represent the points of union between the rhabdome and cladome of the triaenes. In the latter place they are actual apertures, the pores.

In each of the dermal areas embraced by the cladomes of the dichotriaenes there is usually a single pore (Fig. 11, Plate **15**). A few areas are without pores, and here and there a large area containing two or three pores occurs. The pores open into radial pore or ectosomal canals. These are uniporal, and open without chone-like constrictions into subdermal chambers (Fig. 9, Plate **15**), which again open without chone-like constrictions into narrow canals passing into the interior. The subdermal chambers are numerous, subspheroidal, connect with one, or sometimes two pore canals, and lie in the zone where the ectosome passes into the choanosome.

There is no highly specialized cortical fibrous layer, but there is an ectosome devoid of flagellated chambers, and about 200–500 μ thick. It consists of collenchyma, containing very numerous cells, which have a granular body and slender processes. In sections radial to the surface of the sponge, the cells appear spindle-shaped; the processes long, delicate, and fibre-like, frequently extending parallel to the surface. Such tangentially extending fibre-cells are sufficiently abundant throughout the ectosome to imprint a fibrous character upon it. In the immediate neighborhood of the subdermal spaces the fibre-cells are pretty thickly packed, and extend tangentially to the wall of the space.

The ectosome exhibits, in radial sections, small canals here and there, some of which are cut lengthwise, others obliquely, or transversely. "Bläschen," such as are present in *Penares* (*Ecionema*) *helleri* (Lendenfeld, 1894, p. 39), are not present. The ground substance of the ectosomal collenchyma consists chiefly of a homogeneous material, which includes some of the fine granules so abundant in the choanosome. The granules often show an arrangement in vaguely marked groups.

The mesenchyme of the choanosome is dense, although everywhere excavated by small canals and flagellated chambers. The ground substance consists of a homogeneous matrix strewn with fine granules. The granules are angular, less than 1 μ in diameter, and show with an immersion a highly refractive dot in the centre. They are in general very abundant; but are by no means evenly distributed, and tracts of comparatively clear matrix occur commonly. Cells with pseudopodia, and occasionally rounded egg cells (Fig. 5, Plate **15**) with large nucleus are found imbedded in the ground substance. The egg cells are surrounded by a fibrous layer, outside of which is a layer of ground substance, which contains but few granules. A similar clear layer lies round all cells.

Each flagellated chamber is provided with a special afferent as well as with a special efferent canaliculus (Fig. 5, Plate **15**). The two canaliculi are of about the same size. On focussing, it may be seen that the posterior wall of the chamber (boundary membrane) is perforated, the cavity of the afferent canaliculus thus connecting with the set of spaces lying between the collar cells. The chambers are 30–40 μ wide, and if the immediately adjoining part of the efferent canaliculus be included, are pear-shaped.

The chambers (Fig. 5, Plate **15**) have a distinctly developed Sollas's membrane, which is not very deeply concave. The collar cells, here as in *Poecillastra,* are surprisingly few. They are often broken across, one end clinging to the boundary membrane and one to Sollas's membrane. They are frequently unbroken, however, and especially good ones may be found in which the whole cell is doubly contoured, the lower half with the nucleus granular, the upper part clear and expanding so as to embrace a fenestra of Sollas's membrane.

Megascleres.

1. Dichotriaene, Figs. 9, 11, Plate **15.** Rhabdome smooth, tapering to point, 900 μ x 140 μ. Cladi flattened parallel to surface of the sponge; smooth, broad, leaf-like, and irregular. Frequently one of a pair of deuterocladi is reduced to a rounded protuberance. Less commonly one or two of the protocladi may show no sign of bifurcation. Axial canals distinct. Radius of cladome, from centre to apex of cladus, 700 μ; protocladus, 190 μ wide.

The spicules form a single layer at the surface of the sponge, cladomes tangential and supporting the dermal membrane. The cladomes overlap to some extent and frequently interlock, and in general are so connected together as to form a continuous dermal framework. The spicule approaches the shape of the lithistid phyllotriaene, *e.g.* in *Discodermia* (Sollas, 1888, Plate XXXII.).

2. Oxea. Spicule smooth, tapering sufficiently to appear fusiform; slightly curved or sometimes about straight. A characteristic size 2300 μ x 70 μ.——Present in parenchyma, singly, or more commonly in loose sheaves of 2 or 3 to about 6 spicules. For the most part arranged more or less radially, often very obliquely to the surface, and in general not extending into the most superficial region, but stopping about where the rhabdomes of the triaenes begin. In some cases they accompany the triaene rhabdomes. The sheaves and single spicules are abundant, but not at all crowded.

Microscleres.

3. Microrhabd, Fig. 8 *a–d,* Plate **15**. Spicule symmetrically curved, or irregularly bent, sometimes nearly straight. Swollen in middle region, tapering toward ends, which are not pointed but rounded. Exceptionally a spicule, one of the smaller sizes, with pointed ends is found. A faint annular ridge is frequently, but by no means always, visible in middle of the spicule; ridge occasionally well developed. Abnormal spicules with small lateral outgrowths near one end are of rather frequent occurrence. Size, 160 μ x 8 μ to 60 μ x 5 μ.

The spicule is thickly strewn in the superficial layer of the ectosome, lying in the dermal membrane over the triaene cladomes as well as in the pore areas. The spicule is also scattered in small number throughout the ectosome and superficial part of choanosome (Fig. 9, Plate **15**).

4. Oxyaster, Fig. 10 *a–c,* Plate **15**. Rays smooth, slender, conical, about equal in size. Centrum small, but usually perceptible. When the number of rays is large, they appear rather uniformly distributed around the centrum. When they are less in number, it is easy to see that they are not symmetrically distributed. The number of rays commonly varies from about 10 to 20, the spicules with fewer rays being the larger. Diameter of spicule, 16–24 μ; centrum, 2–3 μ in diameter.——Spicule present in some abundance in the walls of the canals, and rather sparsely scattered throughout the parenchyma.

5. Calthrops, Fig. 9, Plate **15**. Rays about equal, 100–170 μ long, smooth, tapering evenly from base to point. Such spicules are present in small number, scattered in superficial part of choanosome. Possibly they represent young stages of the triaenes. As is often the case with the triaenes, the axial canal is abnormally wide, and is open at the ends of the rays.

Under the name of *Stelletta pygmaeorum* O. Schmidt (1880, p. 70, Taf. IX, Fig. 9 *a, b, c*) has described a sponge from St. Vincent, 95 fathoms. Sollas (1888, p. 203) assigns the species, with a query, to *Ecionema* Bwk. Lendenfeld (1903, p. 67) records it among *species dubiae.* Schmidt's description, short as it is, indicates that the skeletal elements are very similar to those of the species here described.

MONAXONIDA Ridley and Dendy.

HADROMERINA Topsent.

POLYMASTIDAE Topsent (1898).

Polymastia Bowerbank.

1864. *Polymastia* Bowerbank, 1864, p. 177.
1887. *Polymastia* Bwk., Vosmaer, 1887, p. 328.
1887. " " Ridley and Dendy, 1887, p. 210.
1896. " " Lendenfeld, 1896, p. 222.
1896. " " Dendy, 1896, p. 249.
1898. " " Topsent, 1898, p. 101.
1900. " " Topsent, 1900, p. 131.

Polymastia maeandria, sp. nov.

Plate 16, Figs. 2, 4-6; Plate 21, Fig. 1.

Diagnosis. Subspheroidal, firm, very light brown in color. Papillae in general low, rounded, wart-like; oscular papillae longer. Entire surface appears smooth, although covered with closely set bouquets of small tylostyles, 280 μ x 12 μ to 124 μ x 5 μ. Superficial covering of projecting tylostyles interrupted by bare pore areas of irregular shape, frequently long and meandering. Cortical layer of large spicules, 500 μ thick; not separated by a fibrous layer from the tylostyli of the surface bouquets; spicules of the layer for the most part tangential; chief spicule a fusiform tylostyle 850 μ x 38 μ to 765 μ x 32 μ. Skeletal bundles radiate from the interior to the surface; chief spicule, a fusiform style 1580 μ x 36 μ to 1020 μ x 28 μ.

Station 3405, one specimen.

Sponge body (Fig. 2, Plate **16**) is subspheroidal, about 20 mm. in diameter, attached by its under surface. In the neighborhood of the lower margin the surface is without mammillary protuberances. Elsewhere wart-like protuberances, not bearing oscula, are scattered over the surface at intervals of about 2 mm. Some are high enough to be hemispheroidal, others much lower; the width commonly about 2 mm., although ranging from 1 to 3 mm. In addition, the upper surface bears near the centre three oscular papillae, each with a terminal osculum which is nearly closed. The papillae are hollow, conical, with rounded tips, 2 to 3 mm. high, and about 3 mm. wide at the base. The thickness of the wall of the papilla exceeds the diameter of the included canal.

The whole surface, including the mammillary protuberances and oscular papillae, is quite smooth to the eye and the touch. The color is a very light brown, the surface lightest near the lower margin. The superficial stratum or cortex is about 700 μ thick, very dense and firm, lighter in color than the interior.

The pore areas (Fig. 1, Plate **21**) are free of spicules; irregular in shape; many long, narrow, and meandering; others rounded. Pores themselves not discernible in surface view, probably closed. Immediately below the dermal membrane of the pore area may be seen, on focussing, the rounded optical sections of small pore canals 20–30 μ in diameter. In radial sections there may be seen in the cortex numerous branching canals. These connect with the narrow pore canals, which extend outward in a more or less radial direction toward the surface. The cortical canals are especially conspicuous beneath the mammillary protuberances (Fig. 6, Plate **16**), where they communicate with the canals of the interior through narrow apertures, each of which perforates a protuberance which projects into the cavity of the internal canal (Fig. 6, Plate **16**). Very probably the protuberance is produced by the contraction of a sphincter guarding the aperture, the apparatus being chone-like.

The cortex or ectosome is collenchymatous. No flagellated chambers were observed in it. In the remainder of the sponge (choanosome) the chambers are thickly packed; mesenchyme of the choanosome, collenchymatous. The flagellated chambers are longer than wide, about 32 μ in transverse section. The collar cells are long and slender; the transparent collar longer than the opaque basal part of the cell; total length of the cell, including the collar, about 10 μ. Very frequently the central ends of the collars are connected in an irregular fashion, as if artificially glued together.

Spicules.

1. Style, Fig. 5 *b*, Plate **16**; smooth, straight, tapering toward both ends so as to be fusiform; pointed end sharp and slender; basal end simply rounded off without enlargement. Size, 1580 μ x 36 μ to 1020 μ x 28 μ. Abundant.

2. Tylostyle, Fig. 5 *a*, Plate **16**; smooth, straight, stouter than the style; fusiform and sharp-pointed; basal end tapering more than the pointed end and capped with a distinct rounded head. Size, 850 μ x 38 μ to 765 μ x 32 μ. Abundant.

3. Tylostyle, Fig. 5 *c*, Plate **16**; similar in shape to the large tylostyle, with which it is connected through intermediate sizes. Size, 280 μ x 12 μ to 124 μ x 5 μ. Abundant.

Skeletal Arrangement.

The surface of the body, exclusive of the oscular papillae, is densely covered with the small tylostyles (spicule 3), which project about 80 μ. The spicules are arranged in diverging tufts ("bouquets" of Topsent), but the bouquets are so densely set that this arrangement is not obvious in surface view (Fig. 1, Plate **21**). The spicules project obliquely over the pore areas, and tend to obscure the boundaries of these areas (Fig. 1, Plate **21**).

The cortex beneath the layer of surface bouquets is filled with a feltwork of spicules, Fig. 6, Plate **16**, chiefly the large tylostyles (spicule 2). This cortical layer is about 500 μ thick, and the greater part of the spicules forming it lie more or less tangentially.

From the interior, near the centre of the attached surface, stout skeletal bundles radiate toward the surface, Fig. 6, Plate **16**. A typical bundle, midway in its course, measures 400 μ in thickness. The chief spicule in the radial bundles is the style (spicule 1). At the outer end of the bundle where it passes into the layer of surface bouquets, the constituent spicules of the bundle, which are arranged lengthwise in it, diverge somewhat.—— In the choanosome between the radiating bundles are some scattered larger spicules, and a considerable number of the small tylostyles.

The outer surface of the oscular papillae (Fig. 4, Plate **16**), like the general surface, is densely covered with the small tylostyles, which here project about 160 μ; spicules arranged in closely set bouquets. The inner, cloacal surface of the papillae is armed with a sparse layer of small tylostyles, which project radially or obliquely for a short distance into the cloacal cavity. Stout bundles of large spicules ascend vertically in the wall, lying about in its middle. A compact cortical layer of spicules, such as occurs elsewhere in the body, is absent, although large tylostyles are scattered in various positions through the papillar wall.

HALICHONDRINA Vosmaer.

HAPLOSCLERIDAE Topsent.

Petrosia Vosmaer.

1887. *Petrosia* Vosmaer, 1887, p. 338.
1887. " Vosmaer, Ridley & Dendy, 1887, p. 9.
1894. " " Topsent, 1894 *a*, p. 8.
1902. " " Lundbeck, 1902, p. 54.

Petrosia variabilis (Ridley).

1884. *Schmidtia variabilis* Ridley, 1884, p. 415, Pls. XXXIX., XLI.
1887. *Petrosia variabilis* Ridley var., Ridley & Dendy, 1887, p. 13, Pl. II., Fig. 12.
1892. *Petrosia variabilis* Ridley, Topsent, 1892, p. 68.
1901. " " " Topsent, 1901 *a*, p. 11, Pl. II., Fig. 9.

Petrosia variabilis crassa, subsp. nov.

Plate 17, Figs. 6, 9, 12; Plate 21, Figs. 2, 3.

Diagnosis. Form variable, subcylindrical, and branching, or more or less plate-like and partially incrusting. *Body stony; interior dense.* Surface smooth to the eye. Oscula, 0.7 to 1.0 mm. in diameter; rather numerous and scattered. Pores in the meshes of the dermal skeleton, one to a few in the mesh. Oxea, 510 μ x 32 μ. Spiculo-fibres of the main skeletal reticulum *300–600 μ thick, consisting of many rows of spicules;* superficial spicules of the fibre only loosely combined with the body of the fibre; meshes rounded and of a diameter about equal to thickness of the fibres. Dermal reticulum merely the outermost part of main skeleton, and not differing essentially from it.

Station 3405, four specimens.

Two of the specimens are subcylindrical sponges broken off below (Fig. 9, Plate **17**), branching above, the branches rounded off at the free ends. The two specimens are much alike, save that in one the elsewhere solid body is excavated for a length of 35 mm. in its lower part by an axial cavity, which has probably been bored out by the crustacean found therein. In the specimen figured, the length is 60 mm., diameter at the lower end 10 mm.

The other two specimens are of a very different habitus. One is an undulating plate which was obviously attached over a part, at any rate, of its smooth lower surface. The plate has a greatest length of 45 mm. and greatest thickness of 5 mm., thinning away toward the edges. The second specimen (Fig. 12, Plate **17**) starts from a similar plate-like expansion, with a smooth under-surface. It then becomes incrusting upon the branching cylindrical skeleton of an alcyonarian, creeping over the latter in several directions in the shape of narrow elevated bands, which are confluent with one another.

The color is a light yellowish-brown. The body is stony and incompressible, and the interior is very dense. The surface appears smooth to the eye, but is rough to the touch. With a lens the points of barely projecting radial spicules may be seen, distributed generally over the surface, in some places thickly enough to form a nearly continuous furze, in other places very scantily. Where the surface is uninjured it appears to the eye, or with a lens, perforate with abundant minute rounded apertures 0.3 mm. to 0.5 mm. in diameter. These which at first sight seem to be simple apertures, are the more conspicuous areas of membrane occupying the meshes of the dermal skeletal reticulum. They are more distinct in Fig. 9, Plate **17**, than in Fig. 12, Plate **17**, simply for the reason that the photograph from which the former figure was made, was taken from the partially dried sponge, while in the other case the photograph was taken from the sponge in alcohol.

The pores are rounded, 50–80 μ in diameter. They lie in the meshes of the dermal skeleton, one to a few in the mesh. In some of the meshes, the dermal membrane exhibits no pores. In the cylindrical specimens, rather numerous small rounded oscula, 0.7 to 1.0 mm. in diameter, are scattered over the body, showing a partial arrangement in longitudinal rows. In the two more or less plate-like forms, oscula similar to those on the cylindrical specimens are scattered here and there over the surface without regularity of arrangement.

Spicules.

Oxeas, Fig. 6, Plate **17**. Spicule smooth, slightly curved, cylindrical and then tapering at each end to a sharp point. Size, about 510 μ x 32 μ. Spicules are sometimes found divided at one end into three short diverging branches. Rarely the spicule assumes the shape of a strongyle or style.

Skeletal Arrangement.

The main skeleton (Fig. 3, Plate **21**, a section vertical to the surface) is a reticulum of thick spiculo-fibres which are frequently indistinctly outlined. The fibres are 300–600 μ thick, consisting of many rows of spicules, arranged for the most part about lengthwise in the fibre, and packed together in a fairly close fashion. The spicules are united by a small amount of spongin, which is insufficient, however, to give the fibre a compact character. The superficial spicules of the fibre are only loosely combined with the body of the fibre, and there are always some free spicules in the meshes. Individual fibres traceable only for short distances. Reticulum undeveloped in spots, such places being occupied by a confused mass of spicules. Meshes more or less rounded; diameter of the meshes about equal to thickness of the fibres.

In the cylindrical specimens longitudinal fibres are vaguely discernible in the axial region. In all the specimens fibres directed more or less radially to the surface, with tangential connectives, may be distinguished in the superficial region of the body.

The dermal membrane is supported by a reticulum (Fig. 2, Plate **21**), which is merely the outermost part of the main skeleton, and does not differ essentially from the latter. It consists of rather poorly defined fibres 400–600 μ thick, enclosing rounded meshes, the diameter of which about equals the thickness of the fibres. Many of the meshes are nearly free of spicules. Others are crossed by numerous scattered spicules, and partly by spicule tracts. Although there are scattered over the surface radially projecting spicules (only the points of which emerge), there are no projecting tufts of spicules, such as in many *Petrosia* species are produced by the continuation of the radial fibres.

On the smooth under surface of the two more or less plate-like forms, the spicules of the dermal skeleton are thickly and irregularly scattered, and not so arranged as to form a reticulum. In spots, however, this continuous layer of irregularly strewn spicules is interrupted by areas of dermal membrane free of spicules, and containing, each, one or a few pores.

Comparative. In the type specimen of *P. variabilis* taken by the "Alert," near Port Darwin, North Australia (Ridley, 1884, p. 415), the oxeas measured 400 μ x 19 μ. In the "Challenger" specimen of *P. variabilis* var. from the Philippine Islands (Ridley and Dendy, 1887, p. 13), the oxeas were 450 μ x 22 μ. In the "L'Hirondelle" specimens of *P. variabilis*, from the Azores (Topsent, 1892, p. 68), the oxeas were 530 μ x 33 μ. In the "Belgica" specimens of *P. variabilis*, from the Antarctic Ocean (Topsent, 1901 a, p. 11), the oxeas were 535 μ x 23 μ.

As to the skeletal arrangement of *P. variabilis* Ridley (1884) says, "Main skeleton — very loose primary lines of spicules, about three spicules broad, running irregularly towards surface, crossed by secondary tracts of similar character, 2 or 3 spicules broad, at right angles to the primaries and about

4 millim. apart. Dermal skeleton — extremely loose tracts of irregularly parallel spicules, 3 or 4 spicules broad, surrounding roundish or polygonal areas from .18 to .28 millim. in diameter."

I have examined the "Challenger" specimen of *P. variabilis* var., and add the following note. The body of *P. variabilis crassa* is much harder and much less cavernous, and the fibres of the main skeleton are much thicker than in the "Challenger" specimen. The surface, in general, of the "Challenger" sponge is distinctly reticulate to the eye. The obvious character of the reticulum, as compared with the condition in *P. variabilis crassa*, is due to the relative slenderness of the fibres and large size of the meshes. Over some parts of the surface, however, the reticulum is very indistinctly developed, the fibres being thicker and the meshes smaller than over the general surface. In such places fibres about as thick, and meshes about as small, as in *P. variabilis crassa* may be found.

Petrosia similis Ridley and Dendy.

1887. *Petrosia similis* Ridley and Dendy, 1887, pp. 9–12, Plates II. III.

Petrosia similis densissima, subsp. nov.

Plate 17, Figs. 7, 10; Plate 21, Figs. 4, 5.

Diagnosis. Sponge irregularly lobate; lobes short, subcylindrical branches, or merely rounded protuberances. Hard, almost stony. Surface appears finely reticulate and smooth to the eye. Oscula, 2–3 mm. in diameter, at or near the free ends of the lobes, leading into cloaca-like cavities. Pores in meshes of the dermal reticulum, 1 to 5–6 pores in a mesh. Oxea, 220 μ x 16 μ. Skeletal fibres compact, consisting of many rows of spicules with but little spongin; 80–180 μ thick. Very few spicules in the meshes of the skeletal reticulum. In the superficial region of the body, main skeletal reticulum regular, consisting of radial fibres with connectives; meshes here 170–250 μ in diameter. In the interior, main skeletal reticulum irregular, with meshes 200–500 μ in diameter. Dermal reticulum merely the outermost layer of the main skeleton; fibres, 170–250 μ thick; meshes, 170–250 μ in diameter.

Station 3405, 1 specimen.

The specimen is an irregular lobate mass, attached below to white conglomerate, upon which for a short distance it spreads out in an incrusting fashion. The mass is 40 mm. high, somewhat flattened; width of the flattened faces about 40 mm. In Fig. 7, Plate **17**, one of the flattened surfaces is shown. Some of the lobes are well marked, though short, subcylindrical branches; others, mere rounded protuberances. The transverse diameter of the branches, and the thickness of the whole mass in

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the short horizontal diameter, are about equal, and 7–8 mm. The sponge is doubtless to be looked on as a ramifying form with subcylindrical branches, the growth in this particular specimen being predominantly, although by no means exclusively, in one vertical plane.

The color is brown, passing here and there into terra-cotta, as if that were a remnant of the natural color. The sponge is hard, almost stony; the canals large enough to give the interior a lacunose appearance when cut across. To the eye or with a lens the surface appears finely reticulate, the reticulum most evident over the larger canals. To the eye and the touch the surface appears smooth, and in reality over much of it there are no projecting spicules. Nevertheless there are plenty of places where spicules project radially for a short distance in considerable number (Fig. 4, Plate **21**).

Rounded oscula, 2–3 mm. in diameter, are found at or near the ends of the branches and on the protuberances. They are the apertures of cylindrical cloaca-like cavities, the inner face of which both laterally and at the bottom shows the openings of efferent canals. The cloaca-like cavities are pretty deep, extending 4–8 mm. into the body of the sponge, but are not continuous with one another. The pores are rounded, 60–80 μ in diameter, and lie in the meshes of the dermal reticulum; 1 to 5-6 pores in a mesh. Pores are closed in some regions, but even then perceptible as rounded darker spots, the rest of the pore area appearing as lighter-colored trabeculae between the closed pores. This condition of the closed pores is sufficiently distinct to appear in a photograph (x 30). The flagellated chambers (Fig. 10, Plate **17**) are somewhat flattened, about 40 μ x 32 μ, and eurypylous.

Spicules. *Oxea,* Fig. 10, Plate **17**; smooth, slightly curved, cylindrical, and then tapering at each end to a point. Size, 220 μ x 16 μ.

Skeletal Arrangement. Main skeletal reticulum (radial section, Fig. 4, Plate **21**), in immediate neighborhood of the surface of the sponge, is regular, with radial and tangential fibres. In the interior, reticulum is irregular, and with larger meshes. Fibres of the main skeleton are in general compact, although in spots they lose their sharp boundaries and fade into one another. In such a spot there is no reticulum, merely a mass of thickly scattered spicules. Fibres, 80–180 μ thick, averaging a somewhat smaller size in the superficial region than in the interior. In the superficial region the connectives are sometimes as thick as the radial fibres, more often somewhat thinner. Meshes of the reticulum, rounded at the corners; in superficial region, 170–250 μ in diameter; in interior, 200–500 μ in diameter.

Spicules of the spiculo-fibres are closely packed in many rows, arranged lengthwise and cemented together by a very small amount of spongin, which does not form a coating over surface of the fibre. Spicules also project irregularly from surface of the fibres. There are almost no free spicules in the meshes.

Many radial fibres are prolonged a short distance beyond the surface, for the length or less than the length of a spicule, thus forming very small projecting tufts. In addition a few separate spicules project radially or obliquely, at points between the ends of the radial fibres, *i. e.* from the fibres of the dermal reticulum between the nodes. But over much of the surface these minute projections are lacking, surface being quite smooth.

The dermal membrane is supported by a reticulum (surface view, Fig. 5, Plate **21**) which is merely the outermost layer of the main skeleton. The fibres measure 60–120 μ in thickness; meshes, rounded-polygonal and 170–250 μ in diameter. As in the main skeleton, the fibres in general are compact and sharply outlined. Here and there spicules project from the fibres well into the meshes, or cross them, but in the meshes in general there are almost no free spicules. Usually in the nodes the crossing of spicule tracts is discernible.

Comparative. I have examined the type specimens of *Petrosia similis* Ridley and Dendy, and find that *P. similis densissima* stands closest to var. *compacta* (Ridley and Dendy, 1887, p. 12). The skeletal fibres of this variety are not nearly so compact as in *P. similis densissima.* This statement applies both to the surface reticulum and to the main skeleton as well. Ridley and Dendy (1887) correctly say that "the skeleton fibre is by no means so compact and well developed" as in *P. dura* (Nardo), whereas in *P. similis densissima* the fibres are fully as compact as in *P. dura* (Specimen No. 1818 in Berlin Museum f. Naturkunde, from Rovigno), and appear more so because there are fewer spicules scattered in the skeletal meshes than in the Mediterranean species. Owing to the comparatively indistinct outlines of the fibres in *P. similis* var. *compacta,* preparations of the dermal membrane and radial sections present a marked difference to corresponding preparations of *P. similis densissima.* Especially the internal skeletal reticulum, as seen in radial section, is confused and indistinct as compared with subsp. *densissima.*

Previously known distribution of P. similis. Petrosia similis: South of Cape of Good Hope (Lat. 35° 4′ S., Long. 18° 37′ E.) at depth of 150 fath.; between Kerguelen and Heard Island (Lat. 52° 4′ S., Long. 71° 22′ E.) at 150 fath. *P. similis* var. *massa:* between Strait of Magellan and Falkland Islands (Lat. 51° 35′ S., Long. 65° 39′ W.) at 70 fath. *P. similis* var. *compacta:* Philippine Islands (Lat. 11° 37′ N., Long. 123° 31′ E.) at 18 fath.

Pachychalina O. Schmidt.

1868.	*Pachychalina* O. Schmidt, 1868, p. 8.		
1887.	*Pachychalina* O. Schm., Vosmaer, 1887, p. 342.		
1887.	"	"	Ridley and Dendy, 1887, p. 19.
1890.	"	"	Dendy, 1890, p. 353.
1894.	"	"	Dendy, 1894, p. 240.
1902.	"	"	Lundbeck, 1902, p. 5.

Pachychalina acapulcensis, sp. nov.

Plate 16, Figs. 7, 8; Plate 17, Figs. 1-5, 13.

Diagnosis. Sponge body an erect lamella, not simple, but a complex composite of erect lobes, many of which are flattened. Lobes intimately connected below, becoming more free and projecting above. Conuli, 3–6 mm. high on the upper portions and projecting edges of the lobes, nearly absent elsewhere. Dermal membrane finely reticulate to the eye. Color yellowish-gray. Sponge very compressible and flexible, yet firm and elastic. Oscula, 2–4 mm. in diameter, over the upper ends and projecting edges of the lobes. —— Oxea very commonly 85–90 μ x 3–4 μ, although larger (100 μ x 5 μ) and smaller (60–85 μ x 2 μ) forms are abundant. —— Skeletal bundles 0.5 to 1.0 mm. thick, formed of closely interlacing spiculo-fibres, ascend more or less vertically through the sponge body and give off oblique branches which terminate as axial bundles in the conuli. Skeletal network extending between the vertical bundles, on the whole irregular, although fibres directed more or less radially to the surface are everywhere distinguishable. Radial fibres in parts of the body, invariably in the conuli, extensively developed; in such places, forming with the approximately transverse connectives a fairly regular skeleton. Stronger fibres of reticulum, 50–80 μ; connectives, 15–30 μ thick; ultimate meshes often about 300 μ wide. Larger fibres well filled with spicules; spongin nevertheless forming a distinct sheath round the fibre. Spongin relatively more abundant in the connectives; spicules here forming from 1 to about 6 rows. —— Dermal reticulum composed of fibres 40–60 μ thick, forming meshes subdivided by fibres 15–30 μ thick; ultimate meshes, 150–350 μ in diameter; fibres like those of main skeleton. Abundant villi commonly about 120 μ high, made up of spicules and spongin, project from dermal reticulum.

Station recorded as "Acapulco," one specimen.

The sponge body is essentially an erect lamella, which is, however, curved so that the two ends of the lamella, shown at the right in Fig. 8, Plate **16**, are brought close together. Possibly the entire lamella in the natural state encircled some slender upright object. The lamella is by no means simple, but may be regarded as composed of numerous erect lobes, many of which are flattened, while others approach the cylindrical shape. The lobes are intimately connected below, becoming more free and projecting above. Many of them appear, moreover, as buttresses projecting from and only partially free from the faces, both inner and outer, of the general lamella. The result of this complex order of growth is that the underlying lamellate character of the body is made less distinct, the sponge appearing at first sight as a fruticose mass. The whole mass in the natural position is 110 mm. wide, with a greatest height of 170 mm.; the thickness of the constituent lobes varying, but in the neighborhood of 12 mm.

Numerous long conuli, covered with villi which are minute but distinct to the eye, are present on the upper portions and projecting edges of the lobes, nearly absent elsewhere. They are 3–6 mm. high, tapering to a point, slenderly conical, or somewhat flattened and spatula-like.

The dermal membrane appears to the eye as a fine reticulum, which only indistinctly allows the arrangement of the internal cavities and parenchyma to be seen. When cut across, the interior appears porous, with very numerous small canals mostly 0.5 mm. or slightly over in diameter. The color is a yellowish-gray. The sponge is very compressible and flexible, yet firm and elastic.

Oscula are scattered in some abundance over the upper ends and projecting edges of the lobes. They are rounded, 2–4 mm. in diameter, and for the most part lead very quickly each into several efferent canals. Pores rounded, 85–250 μ in diameter, in the meshes of the dermal reticulum; mostly one or two in each mesh. Interior of sponge is macerated, but in places the size of the flagellated chambers can be made out; chambers measuring 24 x 20 μ.

Spicules. *Oxea*, smooth, slightly curved, cylindrical, not suddenly pointed but tapering gradually at the ends (Figs. 3, 4, 5, Plate **17**). The variability in the size of the spicule is considerable. Much the commonest size is 85–90 μ x 3–4 μ. Longer and stouter spicules up to 100 μ x 5 μ are, however, not uncommon. Smaller slender forms 60–85 μ x 2 μ are found in the fibres and also scattered sparsely in the meshes of the skeletal reticulum, perhaps representing stages in the development of the larger spicules. Often the spicules in a particular fibre are of nearly the same size, thus in one fibre measuring mostly 85 μ x 4 μ, in another fibre mostly 85 μ x 2 μ.

Skeletal Arrangement. Coarse columns or bundles of spiculo-fibres (*l. b.* in Fig. 7, Plate **16**, and Fig. 2, Plate **17**) extend more, or less vertically through the body, branching as they go. The branches extend obliquely upward and outward, and terminate as axial bundles in the conuli (Fig. 13, Plate **17**). The bundles are well seen in a piece of sponge that has been macerated for some hours in cold caustic potash.

The skeletal network, connecting the columns together and extending between them and the surface, is on the whole irregular. But more or less radially directed fibres, extending out from the branching columns to the surface, may everywhere be distinguished. In some parts of the body (Fig. 2, Plate **17**) and invariably in the conuli (Fig. 13, Plate **17**) they are conspicuously developed, with connectives commonly about at right angles; the skeleton here becoming fairly regular. Elsewhere the radial fibres are sparsely developed (Fig. 7, Plate **16**), and are accompanied by or pass into other strong fibres, which pursue a very oblique or tangential course. The connectives in such regions are without order, and the network is irregular.

The vertical columns have not clearly defined boundaries, but their thickness is in the neighborhood of 0.5 to 1.0 mm. They are composed of coarse spiculo-fibres, 70–110 μ thick, together with finer fibres, all interlacing to form a close irregular network (*l. b.* in Fig. 7, Plate **16**, Fig. 2, Plate **17**). Here and there in the constituent fibres of the column, the spicules are less compactly arranged than elsewhere, and the fibres themselves merge into one another. In such spots the reticular nature of the columns is only vaguely apparent. —— The stronger fibres of the general skeletal reticulum of the body, whether radial, oblique, or tangential, are 50–80 μ thick. The finer fibres or connectives measure 15–30 μ in thickness. In the conuli the radial fibres are slenderer than in the body, about 30–40 μ thick. The ultimate meshes of the skeletal network, as may be seen from the figures, vary a good deal in diameter; a common width being in the neighborhood of 300 μ.

The strong fibres of the general network (Fig. 3, Plate **17**) and of the vertical columns are well filled with spicules; spongin, however, abundant and forming a distinct sheath for the fibre. In the connectives (Figs. 4, 5, Plate **17**) the spongin is relatively more abundant and the spicules are not as closely packed as in the larger fibres, sometimes forming only an axial core. In the finest connectives, the spicules are arranged uniserially; in the coarser, in several series up to about 6. There are a few free spicules, all of the smallest size given above, scattered in the meshes of the skeletal reticulum.

The supporting reticulum of the dermal membrane (Fig. 1, Plate **17**) consists of stouter and finer fibres, like those of the main skeleton. Stouter fibres, 40–60 μ thick, form coarse meshes which are subdivided by finer fibres 15–30 μ thick; ultimate meshes squarish or polygonal with diameter 150 μ to 350 μ. In the larger fibres the spicules are arranged polyserially (about 10 rows); in the finer fibres uniserially or in two to a few rows. From coarse and fine fibres alike project abundant villi, many of them about 120 μ high and consisting of a bunch of spicules, 4 or 5 spicules thick, with considerable horny matter; others consisting of only 2 or 3 spicules. Some of the villi are prolongations of radial skeletal fibres; others are independent projections from the dermal reticulum.

Comparative. The species above described resembles in the lamellate character of its growth, and in some other respects as well, *Pachychalina spinilamella* Dendy (Dendy, 1889), a type specimen of which I have examined. The lamellate character, which is disguised in *P. acapulcensis*, is pronounced in Dendy's. The spicules in *P. spinilamella* are exceedingly slender, measuring about 0.126 by 0.0017 mm.

Oceanapia Norman.

1869. *Oceanapia* Norman, Rep. Brit. Ass., 1868 (1869), pp. 334–35 (generic diagnosis here given is quoted in Bowerbank, 1882, p. 171).
1870. *Rhizochalina* O. Schmidt, 1870, p. 35.
1882. *Phloeodictyina* Carter, 1882, p. 117.
1884. *Rhizochalina* Schmidt, Ridley, 1884.
1887. *Rhizochalina* Schmidt + *Oceanapia* Norman, Ridley & Dendy, 1887, pp. 32, 36.
1894. *Oceanapia* Norman, Dendy, 1894, p. 248.
1894. *Rhizochalina* Schmidt + *Oceanapia* Norman, Topsent, 1894 *a*, p. 10.
1902. *Phloeodictyon* Carter + *Rhizochalina* Schm. + *Oceanapia* Norman, Lundbeck, 1902, pp. 55–56.

Ridley (1884) merged *Phloeodictyon* Carter in *Rhizochalina* Schmidt. Ridley and Dendy (1887, p. 32) suggest that *Rhizochalina* (+ *Phloeodictyon*) and *Oceanapia* Norman should be united, and Dendy (1894) combines the two under *Oceanapia*, while Topsent (1894 *a*) retains the separate genera. Lundbeck (1902) thinks that the group Phloeodictyina (= *Oceanapia*, *sensu* Dendy) includes three separate genera, *Rhizochalina* Schm., *Phloeodictyon*

Carter, *Oceanapia* Norman, and that the group, moreover, is heterogeneous. He proposes therefore to give up the group, and to assign *Rhizochalina* to the *Chalininae, Phlocodictyon* to the *Renierinae, Oceanapia* to the *Gelliinae.* In this report I conceive the genus in the sense of Dendy.

Oceanapia bacillifera, sp. nov.

Plate 17, Fig. 8; Plate 18, Figs. 2–4.

Diagnosis. Only the fistulae known. These are yellowish-brown tubes, 50–80 mm. long and 8–12 mm. in diameter, with unobstructed cavity. Wall of fistula dense and firm, 0.5 to 2.5 mm. thick, with smooth outer surface and nearly smooth inner surface. Spicule, a smooth, cylindrical, distinctly curved strongyle, 360–380 μ x 24 μ. —— Wall of the fistula almost entirely filled with a dense skeleton, the greater part of which forms a vague reticulum, consisting of wide, loose spicular tracts, which bound small, rounded meshes. Spicules united by considerable spongin, and arranged tangentially to the surface of the sponge. In the innermost layer of the wall a few long spicular tracts occur. These give rise to a reticulum with long, narrow meshes, — meshes elongated in the direction of the long axis of the fistula. At the outer surface skeleton not reticulate, spicules here lying side by side, in any particular region parallel to one another.

Station 3404, two specimens.

Both specimens are fragments, including only the fistulae. These are yellowish-brown tubes (Fig. 2, Plate **18**), somewhat curved, and showing here and there low irregular protuberances, or ridges. The tubes are open at both ends, the larger measuring 80 mm. in length, with a transverse diameter of about 12 mm., the smaller 50 mm. in length, with a transverse diameter of about 8 mm. The wall is very firm and dense. Throughout the greater part of the larger tube it is extremely thin, 0.5 mm. thick, although in spots, especially near one end, it attains a thickness of 2.5 mm. In the smaller specimen the wall is thicker, the thickness ranging from 0.75 mm. to 2.0 mm. In both specimens the cavity of the tube is unobstructed, the outer surface quite smooth, the inner surface somewhat less so, and showing closely set whitish lines which course longitudinally, and, anastomosing, form a reticulum with narrow, elongate meshes. These lines represent the innermost layer of the skeletal reticulum.

No dermal membrane is present, the superficial layer of spicules being quite bare (surface view, Fig. 8, Plate **17**), except in spots, where they are covered by exceedingly thin patches of an incrusting species of

Hymeraphia Carter (the spicules of which are shown in Fig. 3, Plate **18**), differing in some few details from *Hymeraphia minima* Topsent (1892, p. 114, Plate **11**, Figs. 2–3).

Spicules. Strongyle (Fig. 8, Plate **17**), smooth, cylindrical, distinctly curved, ends evenly rounded off. Size, 360–380 μ x 24 μ.

Skeletal Arrangement. The wall of the fistula is supported by a dense skeleton, which appears as a confused mass of strongyles (Fig. 4, Plate **18**, a tangential section), arranged for the most part tangentially to the surface of the sponge, but lying in all (tangential) directions, united by considerable spongin, and interrupted here and there by rounded gaps. This mass of spicules may be regarded as forming a reticulum, which consists of vaguely outlined fibres, or tracts bounding small rounded meshes. The tracts are often 150–200 μ thick, the meshes somewhat less in diameter than the thickness of the tracts. Individual tracts are traceable only for short distances. Spicules of a tract arranged loosely and about lengthwise; united together with considerable spongin.

The dense skeleton occupies most of the thickness of the wall, extending nearly to the inner surface of the fistula. The innermost layer — about 100 μ thick — of the fistular wall contains a good many canals and granular cells, and comparatively little skeleton. What skeleton there is has the shape of vaguely defined tracts about 200 μ thick, which resemble those of the skeleton in general, but most of which pursue an approximately longitudinal course for considerable distances. The longitudinal tracts, together with similar connectives, give rise to a reticulum, the meshes of which are long and narrow.

The dense skeleton extends quite to the outer surface of the fistula, but in its outermost layer the reticular character is lost, the spicules here lying side by side, in any particular region parallel to one another (Fig. 8, Plate **17**, surface view).

In the region occupied by the dense skeletal reticulum, only the spicules and spongin are discernible in the present state of the sponge, and although maceration has undoubtedly gone on, there cannot in the natural condition be much soft tissue in this part of the fistula.

Comparative. As regards the shape of the spicules the fistulae here described most closely approach *Oceanapia singaporensis* Carter. In the type of this species (*Phloeodictyon singaporense* Carter, 1883, p. 326) the spicules are of two forms: oxeas and strongyles, the latter about $\frac{1}{4}$ the length of the former. The oxeas are chiefly confined to the spiculo-fibre of the interior, the strongyles to the surface layer. *Habitat*, Singapore.

Under the head of *Rhizochalina singaporensis* Carter var., Ridley (1884) describes specimens "in which a large proportion of the (usually acerate) spicules have both ends more or less rounded." "The largest adult spicules have nearly the same size as the acerates of *R. fistulosa*, viz., .3 x .0127 mm., but they vary immensely in length." *Habitat*, Prince of Wales Channel, West and Alert Islands, Torres Straits, 7 fathoms.

Ridley and Dendy (1887, p. 34) record under *Rhizochalina singaporensis* Carter a fistula taken by the "Challenger" (locality uncertain). I have examined this specimen, and in my preparations the spicules were nearly all strongyles. In the skeletal arrangement and color this specimen differs from *O. bacillifera.* —— The sponge identified by Lindgren (1898, p. 297, Taf. 19, Fig. 11 *a–b*) as *Rhizochalina singaporensis* Carter must, from the present standpoint of classification, be placed in another genus, since it has chelae.

In the color and general appearance the fistulae, here described as *O. bacillifera*, are very similar to fistulae taken off Bahia by the "Challenger," and referred, with a query, by Ridley and Dendy (1887, p. 34) to *Rhizochalina putridosa* (? Lamarck), but in these specimens the spicules are oxeas, and the reticulate character of the skeleton is strongly marked.

Gellius Gray.

1867. *Gellius* Gray, 1867, p. 538.
1887. *Gellius* Gray *pars*, Vosmaer, 1887, p. 349.
1887. *Gellius* Gray, Ridley & Dendy, 1887, p. 37.
1894. " " Topsent, 1894 *a*, p. 8.
1894. " " Dendy, p. 247.
1902. " " Lundbeck, p. 62.

Gellius perforatus, sp. nov.

Plate 17, Fig. 11; Plate 18, Fig. 1; Plate 21, Fig. 6; Plate 22, Fig. 1.

Diagnosis. Body may appear as a flattened plate-like mass, perforated by spaces which pass through from one surface to the other; or as an amorphous mass excavated by spaces which pass through the body in several planes, and divide it into a number of anastomosing lobes. Color ashy gray. Sponge firm and of cartilaginous consistency. —— Upper and lower surfaces differentiated. Upper surface roughened with closely set minute projections which reach 1 mm. in height, and consist of, or are supported by, tufts of spicules projecting from the dermal reticulum. Under surface as compared with the upper is smooth. —— Oscula small and scattered over upper and outer surfaces. Pores abundant in meshes of dermal reticulum of upper surface; scattered over lower surface, in places abundant.

Spicules : Oxea, 320 μ x 20 μ, with smaller sizes. Sigmata 18 μ long, abundant. Main skeleton a confused irregular reticulum of spiculo-fibres, with abundant free spicules scattered between the fibres. Fibres consist chiefly of spicules, with only a very small amount of spongin, and in general are not sharply separated from the scattered spicules. On the upper surface is a dermal reticulum of spiculo-fibres from which single spicules and tufts of spicules everywhere project. On the lower surface a dermal reticulum is developed in places, the membrane elsewhere containing only scattered spicules.

Station given as Panama, 4 specimens.

The largest specimen, Fig. 1, Plate **18**, is an irregular plate, the under surface of which has apparently been moulded over several rounded objects. The plate is 5 to 10 mm. thick, with a greatest width of 95 mm. Perforating spaces 4 or 5 mm. in diameter pass through the body, from the upper to the lower surface. The upper surface, which is the one figured, is very uneven, and from it project numerous lobes having the shape of low rounded or irregular elevations, often with a subterminal osculum. It is apparently the case that such elevations are primarily simple and independent, but in some instances in the course of lateral expansion they meet and fuse with one another, thus roofing in tunnel-like spaces which come to lie between the body of the plate and the fused lobes. On the under surface, too, especially near the periphery, some similar tunnel-like spaces have been formed, apparently by the fusion of lobes growing out from this surface.

Of the other specimens, two are fragments of similar plate-like masses, and may indeed have been broken off from the larger piece just described. In one of them the perforating spaces, passing through the body from upper to lower surface, are large, reaching 15 mm. in diameter. And the lobes projecting from the under surface, and fusing in the manner described, give the mass a thickness of 30 mm.

The remaining specimen has a different shape. It is an amorphous mass about 40 mm. in diameter, and consists of a few irregular but in the main subcylindrical lobes, 5 to 15 mm. thick, anastomosing in several planes and thus enclosing spaces which continue to pass quite through the body of the sponge, and have a diameter themselves of 5 to 15 mm. The upper and lower surfaces of the whole mass are readily distinguishable, resembling the corresponding surfaces of the flattened plate-like specimens.

On comparing the different specimens, and making some use of hypothesis, it becomes possible to describe the habitus of the species in the following way. The sponge has differentiated upper and lower surfaces. Primarily solid, in the course of growth it develops lobes, which may spread and fuse, not only in the horizontal plane, but in planes above and below the level of the original body. Thus spaces are partially enclosed which continue to pass through the body in various planes. The enclosed spaces may be small or large, and thus the whole mass comparatively compact or very cavernous. If the growth be predominantly in the horizontal plane, a flattened plate-like body results. When the growth is not predominantly in one plane, a labyrinthine mass of anastomosing lobes results.

Except in shape, the several specimens agree. The color is a light ashy gray. The sponge is firm, only very slightly compressible, and of a marked cartilaginous consistency.

The upper surface is in general roughened with closely set minute projections which vary a good deal in character. In regions (part of Fig. 1, Plate **18**), the projections are fittingly designated as villi, and consist of small tufts of more or less radially disposed spicules, a tuft including only 2 or 3 spicules. Round the base of such tufts the sponge tissue forms an elevation, and thus the projection is strictly conical, although very slender. Such villi are exceedingly abundant over parts of the surface, especially in the peripheral region of the sponge. —— The villi intergrade with the larger elevations with which the greater part of the surface is thickly covered, and which reach 1 mm. in height. These elevations, which may be referred to as conuli, taper toward the apex. In their distal portions at any rate, they are supported by the larger dermal tufts of spicules, and (hence) frequently appear branched. In places the conuli are especially low and feebly developed, such regions being almost smooth.

The under surface, as compared with the upper, appears in general smooth to the eye and the touch, noticeable villi or conuli appearing only here and there.

Fairly numerous round oscula, 1.5 to 2 mm. in diameter, are scattered over the upper and outer surfaces. They lead into deep main canals, and are especially developed on the prominences. —— To the eye the dermal membrane of both surfaces appears imperforate and opaque. In the meshes of the dermal reticulum of the upper surface numerous afferent canals the larger of which measure 80–120 μ in diameter, and which in many places are separated only by thin partitions 10–50 μ thick, abut against the dermal membrane. The pores on this surface, which in some places are closed, but in many regions are open, measure 20–40 μ in diameter, and lie thickly crowded in the meshes of the dermal reticulum. Those overlying the more conspicuous afferent canals seem with a low magnification to form rounded pore areas, which have about the same diameter as the canals.——The dermal membrane of the under surface is in places riddled with pores, but elsewhere pores appear only here and there, probably owing to closure.

Spicules. Megascleres. 1. Oxea (Fig. 11, Plate **17**), smooth, slightly curved; points usually sharp, occasionally rounded off, one end rarely strongylate. Spicule abundant. Common size is about 320 μ x 20 μ, although smaller sizes occur grading down to spicules only 150 μ x 2–3 μ. The latter are probably young stages in the development of the characteristic oxea.

Microscleres. 2. Sigmata (Fig. 11, Plate **17**), 18 μ long by something less than 2 μ thick, are abundantly scattered through the parenchyma and in the dermal membrane of both surfaces.

Skeletal Arrangement. In the main skeleton the oxeas are arranged in spiculo-fibres, and are also scattered without order between the fibres. The spiculo-fibres, which are often very loose and best described as tracts, form a confused irregular reticulum, the meshes of which differ greatly in size (Fig. 1, Plate **22**, a section vertical to surface). The fibres are of varying thickness, from 200 μ, representing about 10 rows of spicules (as seen in optical section), to 80 μ, or even thinner. They consist of spicules arranged for the most part lengthwise in the fibre, and held together by a very small amount of spongin. In the body of the fibre the spicules are pretty densely packed, becoming loosely arranged at the surface. Thus the fibres in general are not sharply separated from the scattered spicules.

The fibres may be fairly compact, and the spicules which are scattered in the meshes rather few in number. In such spots the reticular nature of the skeleton is obvious. In other spots the fibres are looser and the scattered spicules more abundant, and the reticular nature is obscured. In still other spots the reticular nature is practically lost, there being in such places only a confused mass of spicules. In the superficial region of the sponge, fibres may be distinguished which extend radially to the surface.

The dermal membrane of the upper surface is supported by a reticulum of tangential spiculo-fibres, 70–175 μ thick, which produce ridges on the surface. Meshes irregularly polygonal or rounded, and varying greatly in size, from 1 mm. to 200 μ in diameter (Fig. 6, Plate **21**, surface view). The meshes contain, as a rule, no or only a few free spicules. In the larger meshes some free spicules are generally present, and they are frequently combined to form slender tracts, 1 to about 3 spicules thick, which more or less perfectly subdivide the mesh (as in the centre of Fig. 6, Plate **21**). The fibres resemble the more compact fibres of the main skeleton. While the dermal reticulum on this surface is in general well developed, there are small areas here and there in which the fibres merge into one another, thus obscuring or obliterating the reticular character.

From the dermal reticulum of the upper surface, single spicules and tufts of spicules everywhere project freely. The latter range from very small tufts including only 2 or 3 spicules to tufts formed by the prolongation of radial fibres of the main skeleton (Fig. 1, Plate **22**), or by the oblique prolongation of dermal fibres (Fig. 6, Plate **21**), and which at the base have about the thickness of the fibre. The larger tufts are abundant, measure 350–500 μ in length, and commonly split distally into branches, each branch including from 1 to 2 or 3 spicules.

On the under surface a dermal reticulum similar to that of the upper surface is developed in places. Elsewhere such a reticulum is absent, the membrane containing only scattered spicules lying tangentially and crossing at all angles. The non-reticular condition seems to predominate at this surface. In the non-reticular regions there may be no projecting spicules, the membrane being quite smooth. Or single spicules, and less often small tufts of 2 or 3 spicules, project.

Comparative. The species here described resembles some others, assigned to *Gellius* by recent writers, in that the spicules are in parts of the sponge combined to form spiculo-fibres, which nevertheless are poor in spongin, and do not form a continuous fibrous skeleton as in *Gelliodes* Ridley. Among such species may especially be mentioned *Gellius flagellifer* Ridley & Dendy (1887; Lundbeck, 1902).

POECILOSCLERIDAE Topsent (1894).

Tylodesma Thiele.

1870. *Desmacella pars* O. Schmidt, 1870, p. 53.
1880. *Desmacodes* O. Schm. *pars* Vosmaer, 1880, p. 104.
1885. *Gellius* Gray *pars* Vosmaer, 1885, p. 28.
1887. *Gellius* Gray *pars* Vosmaer, 1887, p. 349.
1887. *Desmacella* Schmidt, Ridley & Dendy, 1887, p. 58.
1892. *Biemma* Gray + *Desmacella* O. Schm. *pars* Topsent, 1892, p. 80.
1894. *Biemma* Gray, Topsent, 1894 *a*, p. 11.
1902. *Biemma* Gray, Lundbeck, 1902, p. 82.
1903. *Tylodesma* Thiele, 1903, p. 944.

Thiele (1903, pp. 943–44) remarks that Schmidt, when he established the genus *Desmacella* (1870, p. 53), included in this genus, along with his several new species, *D.* (*Hymedesmia*) *johnsoni* (Bwk.), which was the type of *Hamacantha* Gray (1867, p. 538); that *Desmacella* is therefore a synonym of *Hamacantha*, and must be cancelled, as Vosmaer has already pointed out.

Thiele further calls to mind that Gray, in establishing the genus *Biemna* (1867, p. 538), names as the only certain species *Biemna* (*Desmacidon peachii* Bwk.); that this species is commonly assigned at the present time to *Desmacella;* and that the name *Desmacella* as used in the customary sense of to-day should be replaced by *Biemna.*

For the group of species included in the genus *Biemna* (*sensu* Topsent, 1892, 1894 *a*), Thiele proposes the name of *Tylodesma.*

Thiele's contention that *Desmacidon peachii* Bwk., which has been commonly assigned since 1870 (O. Schm. 1870, p. 77) to *Desmacella*, and similar sponges should again be designated as species of *Biemna* Gray, and that *Biemma sensu* Topsent (1892, p. 80) cannot be maintained, is, I think, incontestable. (Rules for Zool. Nomenclature in Verhdlg. v. Intern. Zool.-Congress, p. 966, Art. 2.)

The name *Desmacella* is strictly a synonym, and Vosmaer (1885, p. 28; 1887, p. 221) and Thiele (1903) are therefore justified in cancelling it. The new species described by Schmidt under this name (1870, p. 53) nevertheless constituted a new group, which was homogeneous and is identical with *Biemna* as defined by Topsent in 1892, and recently again defined by Lundbeck (1902). Ridley and Dendy (1887, p. 58) regard these species as "the types of the genus *Desmacella*," and retain the name. Vosmaer (1880) designates them *Desmacodes*, but this name cannot be retained for them, since in the type of *Desmacodes* (*D. subereus* O. Schm., 1870, p. 54) the predominant megasclere is an oxea (*Spindelnadel*). Vosmaer later (1885, pp. 28–29; 1887, p. 349) merged *Desmacodes* Schm. in *Gellius* Gray, and accordingly one of Schmidt's species was designated by him *Gellius vagabundus*. But in *Gellius* (Gray, 1867, p. 538) the megascleres are diactinal, while in Schmidt's species they are tylostyles (*Stecknadeln*). In *Gellius*, therefore, the sponges will not go.

There is the more reason to follow the example of Ridley and Dendy, and retain the name *Desmacella* for the group, of which *D. vagabunda* Schm. and *D. pumilio* Schm. serve as types, since Schmidt himself later (1880, p. 82) removed *D.* (*Hymedesmia*) *johnsoni* (Bwk.) from the genus. Moreover, Schmidt's generic diagnosis was obviously made especially to fit his new species, and he refers to *D. johnsoni* as "ein sich isolirt habender Nebenzweig von *Desmacella*" (1870, p. 54). Nevertheless, the case is one in which the rules of nomenclature demand a new generic name, and I have adopted that proposed by Thiele.

Tylodesma alba, sp. nov.

Plate 18, Figs. 5-7; Plate 22, Figs. 2, 3.

Diagnosis. Sponge body massive or lamellate. Surface differentiated into pore and oscular regions, these regions occupying opposite surfaces when the body is lamellate, intermingling to some extent when the body is massive. In the oscular regions the dermal membrane is smooth, and imperforate save for scattered small oscula, which occur singly or in groups of 2 to 4. In the pore regions the dermal membrane is rough and exhibits numerous pore membranes perforated by 1 to a few pores. Sponge firm; color of surface white. —— *Spicules.* Tylostyles, 1275 x 36 μ to 290 x 8 μ. Sigmata, 64 to 22 μ long. —— Main skeleton loose, consisting of tracts of spicules and scattered spicules. Dermal membrane of the smooth nonporous regions densely filled with tangentially disposed tylostyles. In the rough porous regions more or less radially disposed tracts expand to form superficial brushes of small tylostyles, which project beyond the surface.

Station 3405, one entire specimen and a fragment.

The entire specimen has roughly the shape of a truncated pyramid, inverted so that the base of the pyramid is represented by the upper surface of the sponge, the truncated apex by the lower surface, which is attached to conglomerate. In Fig. 7, Plate **18**, the sponge is viewed obliquely so that the upper surface is plainly seen. This surface is polygonal with six sides, longer in one direction; unevenly concave, rising gradually toward the edge which is rounded and projects outward. The lateral surface of the sponge is divisible into six uneven faces, which slope suddenly away from the upper edge toward the contracted base. The height of the mass is 50 mm., its greatest width 75 mm. Behind the main body, when the latter is seen in the position of Fig. 7, Plate **18**, the sponge extends for a short distance in incrusting fashion over the conglomerate, and then rises up in the shape of a small nearly vertical lamella which is partially divided into two lobes and is about 5 mm. thick.

The upper surface of the main body is covered with a smooth dense membrane, which is quite imperforate save for the oscula. A similar membrane covers the ridges and prominent parts of the lateral surface and one surface of the lamellate continuation. The more depressed parts of the lateral surface of the main body, comprising the greater part of this surface, appear to the eye rough and comparatively porous, and one surface of the lamellate continuation has this appearance. Microscopic examination shows that in the rough regions the dermal membrane is plentifully perforated with pores. Thus the surface of the sponge is differentiated into pore and oscular regions, these regions occupying opposite surfaces where the body is lamellate, but intermingling to some extent where the body is massive.

The oscula measure 1 to 2 mm. in diameter, and are found scattered irregularly over the smooth regions, sometimes singly, but more often in small groups of two to four. In the rough regions numerous pore membranes roofing in canals are distributed irregularly. The membranes are rounded or irregularly shaped, perforated by one to a few pores, and measure from 2 to 3 mm. to a fraction of 1 mm. in diameter. The individual pores are mostly about 200 μ in diameter, with larger ones occurring less frequently.

The color of the surface is white, that of the interior light brown. The sponge is firm.—— The flagellated chambers are rounded, 28 to 36 μ in diameter. The arrangement of the chambers and canals indicates that the chambers are eurypylous, although the actual openings cannot be made out.

Spicules. Megascleres. 1. Tylostyle, Fig. 5, *a–d*, Plate **18**; smooth, sharp-pointed, slightly curved; head well marked; tapering toward head end as well as toward point. Size varies from 1275 μ x 36 μ to 290 μ x 8 μ. Rarely the spicule appears strictly diactinal, bearing an enlargement at some point along its course, whence it tapers to a point at each end.

Microscleres. 2. Sigmata, Fig. 6, *a–g*, Plate **18**, scantily distributed through parenchyma, becoming fairly abundant in places. They vary greatly in size, ranging from 64 to 22 μ in length. The microscopic pictures afforded by the spicules differ a good deal in appearance, but the spicules all have essentially the same shape.

Skeletal Arrangement. The main skeleton (Figs. 2 and 3, Plate **22**, sections radial to the surface) is loose, consisting of irregularly disposed tracts of spicules and scattered spicules. The larger-sized spicules, 800 μ and upward in length, predominate. In the superficial region numerous tracts, extending more or less radially to the surface, are distinguishable. The spicules are cemented together here and there by very small amounts of yellowish and distinctly stratified spongin.

The dermal membrane of the smooth, non-porous regions is densely filled with tylostyles, disposed tangentially or slightly obliquely to the surface, and forming several layers (Fig. 3, Plate **22**; lower part of Fig. 2, Plate **22**). As in the main skeleton the larger-sized spicules predominate.

In the rough, porous regions, the radial or obliquely radial tracts expand to form superficial brushes of small tylostyles, which project beyond the surface (upper part of Fig. 2, Plate **22**). The spicules of the brushes measure for the most part 500 to 290 μ in length. Some of the brushes project radially from the surface, but many project so obliquely as to lie almost flat. The flat brushes, in which the spicules diverge widely, and which consequently present a fan-like appearance, point in all (tangential) directions, and in places cross one another to some extent.

Comparative. *Tylodesma alba* resembles in different points several of the species from the Florida coast briefly described by Schmidt (1870, p. 53) under the name of *Desmacella.* Thus, as in *Desmacella pumilio* O. Schm., the tylostyles are "theils geschichtet, theils in Fasern und ragen mit den Spitzen hervor." The smooth dermal membrane found over a large part of the surface corresponds to that described for *D. vagabunda* O. Schm. Flattened brushes of spicules similar to those present over the rough parts of the surface in *Tylodesma alba* are mentioned by Schmidt as characteristic of *Desmacella vicina:* "mit flachen, oft fächerigen Zügen von Stecknadeln."

In the fact that the pore- and osculum-bearing surfaces are differentiated, *T. alba* resembles *T.* (*Biemma*) *grimaldii* Topsent (1892), which apparently lacks the striking peculiarity common to *T. alba* and *T. vagabunda* O. Schm., *viz.* the smooth dermal membrane filled with tangentially arranged tylostyles.

Tylodesma vestibularis, sp. nov.

Plate 18, Figs. 8, 9; Plate 19, Fig. 1; Plate 22, Fig. 4; Plate 23, Figs. 1-3.

Diagnosis. Sponge primarily incrusting, but it may so grow as to completely incorporate the substratum, thus appearing massive. Surface exhibits numerous vestibular spaces, appearing as elongated cavities extending tangentially, and separated from the exterior only by the dermal membrane; opening at one end by an osculum. Transverse diameter of such spaces, 1 to 4 mm.; length, frequently 10 to 20 mm. Dermal membrane in general riddled with pores. Color, light yellowish-brown. Sponge moderately firm, but very brittle. —— *Spicules.* Tylostyles, 630 μ x 16 μ to 240 μ x 8 μ. Sigmata commonly 36 to 12 μ long. —— Main skeleton consists of scattered tylostyles and irregularly disposed short tracts of same spicule. In the superficial region numerous radial or obliquely radial tracts are distinguishable, ending at the surface in projecting brushes. The adjacent obliquely radial tracts, with their terminal brushes, are prolonged into the vestibular membranes, there occupying an approximately tangential position.

Station 3405, one specimen.

The sponge (Fig. 1, Plate **19**) is incrusting, below upon conglomerate, above upon the dictyonal framework of a *Hexactinella,* which agrees, in regard to the framework, with *H. labyrinthica mihi,* and very probably is this species. The thickness of the incrusting sponge, external to the conglomerate or Hexactinellid support, is about 1 mm., or often less. The conglomerate is in part a firm, solid mass; in part, of a very loose composition. Where the mass is loose, consisting of bits of shells, spines, annelid tubes, and Polyzoa, the sponge has grown into all the crevices between the component particles, and aids in holding them together. Above, the sponge does not form a mere incrustation upon the surface of the *Hexactinella* skeleton, but has incorporated the latter, having so grown through its interstices that the Hexactinellid framework is now found in the interior of the sponge, along with the proper Monactinellid skeleton (*vide* Fig. 4, Plate **22**, and Fig. 1, Plate **23**, sections vertical to the surface). Over a part of the surface the lobes of the supporting *Hexactinella* remain distinct, although they have been individually incorporated by the *Tylodesma.* But over most of the surface the primitively incrusting sponge has filled up the gaps between the *Hexactinella* lobes, thus assuming the character of a continuous amorphous mass. This mass is, however, excavated internally by some large cavities, which probably represent spaces between the *Hexactinella* lobes. The *Hexactinella* skeleton is in a measure disintegrated, and along with it the massive part of the *Tylodesma* has incorporated other fragments of a stony nature, most of which seem to be particles of echinoderm spines. The massive part of the specimen is 70 mm. wide, 30 mm. thick, and 40 mm. high.

The surface exhibits numerous vestibular spaces, appearing as elongated, irregularly tubular cavities, often branching, extending tangentially beneath the surface, and separated from the exterior only by thin dermal membrane. One of the largest of these spaces is shown in Fig. 1, Plate **19**, to the left. The transverse diameter of such spaces varies from about 1 to 4 mm. The length, which is often difficult to measure, owing to the meandering course of many of the spaces, is frequently 10 to 20 mm. At one end many, probably all, of the spaces communicate with the exterior through an osculum 1 to 4 mm. in diameter. (The surface of the sponge is injured here and there, and the natural apertures are not everywhere discernible with certainty.) The membranous covering of the spaces is moreover perforated here and there by apertures 85 to 200 μ in diameter, scattered singly, or in small groups. At the non-oscular end the vestibular spaces lose themselves in the more solid sponge tissue. The spaces are larger and comparatively far apart in the massive part of the sponge body, smaller and much more abundant where the sponge is spreading over a loose, broken substratum.

The surface of the sponge between the vestibular spaces appears to the eye dotted with small, round areas, about 0.5 mm. in diameter. These vary greatly in abundance, being in places 1 to 2 mm. apart, but again only scantily scattered. They are perforated membranes roofing in canals of corresponding size, which pass radially into the interior. The membranes for the most part contain several apertures, but sometimes only one, which probably are to be regarded as oscula.

The dermal membrane in general is riddled with thickly strewn pores, which vary considerably in size, the diameter ranging at any rate from 85 to 220 μ. Small subdermal cavities everywhere underlie the dermal membrane. —— The flagellated chambers are 32–36 μ in diameter, and are crowded together in regions which are separated by collenchymatous tracts, the latter traversed by the larger canals. The arrangement of the chambers in the trabeculae of the sponge indicates that they are eurypylous. —— The color is a light yellowish-brown, the membranes roofing in the vestibular spaces appearing translucent and darker than the general surface, when the body is immersed. The sponge, while moderately firm, is exceedingly fragile, owing to its great brittleness.

Spicules. Megascleres. 1. Tylostyle, Fig. 8, *a–c*, Plate **18**; smooth, very slightly curved, with small head. Spicule tapers slightly toward tylote end as well as toward pointed end, but in the smaller sizes the tapering toward the tylote end is scarcely perceptible. Size ranges from 630 μ x 16 μ to 240 μ x 8 μ. The smaller sizes — 240 to 350 μ in length — predominate in the surface brushes and the vestibular membranes; the larger, in the radial tracts and the loose skeleton of the interior.

Microscleres. 2. Sigmata, Fig. 9, *a–c*, Plate **18**. Length ranges from 45 to 10 μ; common sizes from 36 to 12 μ in length. The sigmata are abundant in the parenchyma and general dermal membrane; only scantily present in dermal membrane over the larger vestibular spaces.

Skeletal Arrangement.

In the deeper parts of the sponge which are occupied by the Hexactinellid skeleton, tylostyles are scattered separately and in slender short tracts, without arrangement. In the superficial region numerous radial or obliquely radial tracts extend toward the surface, there ending in projecting brushes composed of diverging short tylostyles (Fig. 4, Plate **22**; Fig. 1, Plate **23**). Spongin appears to be absent. At any rate, it was not to be observed either in balsam or glycerine sections or teased preparations.

While the surface in general is covered with the projecting brushes, between which small subdermal cavities very commonly lie, in the dermal membrane covering the vestibular spaces the surface skeleton has a different character. The obliquely radial tracts which are adjacent to such a space extend out into the covering membrane (Fig. 4, Plate **22**, section vertical to the surface; Fig. 3, Plate **23**, surface view of comparatively large vestibular space with some of the surrounding area), thus coming to occupy a tangential or nearly tangential position. In the case of the smaller and medium-sized spaces the tangential tracts, as they pass from the margin toward the middle of the vestibular membrane, preserve their individuality (Fig. 3, Plate **23**). In some cases, the whole tract occupies a tangential position, the terminal spicules spreading out fan-wise in the horizontal plane. In other cases, while the body of the tract lies tangentially, the terminal spicules form a diverging bunch which points obliquely upward much like the bunches of spicules found over the general surface. Both conditions appear in Fig. 3, Plate **23**.

In the tracts of spicules which extend out into the membranes covering the larger vestibular spaces, all of the spicules lie in a tangential or nearly tangential position. These tracts lose to a greater or less extent their individuality (Fig. 2, Plate 23, surface view of part of a large vestibular membrane. The upper, left, and lower margins of the figure represent cut edges. The right curved margin represents part of the edge of an osculum. The left and lower margins are not far from the periphery of the entire membrane), in that they become loose and fray out terminally into free spicules, which are scattered in moderate number through the membrane. Some of the tracts are prolonged for considerable distances through the membrane as narrow stream-like bands, which eventually break up into free spicules.

Comparative. The spicules in *T. vestibularis* are pretty close to those of *T. corrugata* (Bwk.) (*Biemma corrugata,* Topsent, 1892), a parasitic form. Moreover, Topsent says the spicules at the surface are arranged in divergent bunches ("en bouquets divergents"). But Bowerbank describes (1866, pp. 242–3) and figures (1874, Plate XLIII., Fig. 3) the dermal membrane of this sponge (*Halichondria corrugata* Bwk.) as strongly reticulated, and vestibular spaces such as occur in *T. vestibularis* are not mentioned by either writer.

Lundbeck (1902, p. 82) describes in detail a *Tylodesma* (*Biemma rosea* Frst.) known in plate-like fragments, which bear the pores on one surface, the oscula on the other. With this well-marked species, which he so excellently describes, Lundbeck thinks it possible to identify another specimen of a very different habitus. This is a little sponge occurring as a thin incrustation on a Hexactinellid skeleton, and which Lundbeck regards as a young individual. In the description of this specimen Lundbeck does not go into details, and it may be questioned whether it belongs to *T. rosea.* Lundbeck's description of *T. rosea* in general would indicate that this particular specimen and *T. vestibularis* have some points of resemblance in addition to the parasitic habit.

Iophon Gray.

1867. *Iophon* + *Alebion* Gray, 1867, p. 534.
1887. *Iophon* Gray *pars*, Vosmaer, 1887, p. 354.
1887. *Iophon* Gray, Ridley & Dendy, 1887, p. 116.
1892. *Dendoryx* (*Iophon*) Gray, Topsent, 1892, p. 96.
1894. *Iophon* Gray, Topsent, 1894 *a*, p. 14.

Iophon chelifer Ridley and Dendy.

1887. *Iophon chelifer* Ridley & Dendy, 1887, p. 119, Plates XVI., XVII.
1893. *Iophon chelifer* R. & D., Lambe, 1893, p. 30, Plate II., Figs. 7, 7, *a–f*.
1896. " " " Lambe, 1896, p. 191.
1900. " " " Lambe, 1900, p. 23.

Iophon chelifer ostia-magna, subsp. nov.

Plate 20, Figs. 2, 4, 10, 11; Plate 24, Fig. 1.

Diagnosis. Body plate-like, 5 to 8 mm. thick, with rounded free edge bearing large oscula 4 to 6 mm. wide, which are the openings of correspondingly wide efferent canals. Color dark brown. Upper and lower surfaces alike. Small oscula mostly 300–500 μ in diameter, but reaching diameter of 2 mm., scattered abundantly over both surfaces, and also present at the free edge. Pores abundant, scattered throughout dermal membrane. —— *Spicules.* 1. Style, 440 by 20 μ, sparingly spinose. 2. Subtylote, 315 by 8 μ, ends feebly spinose. 3. Chelate bipocillus, 16–20 μ long; axis terminating at one end in 2 or 3 pointed teeth, at other end in a curved plate divided into 2 or 3 lobes. 4. Anisochela, 12–20 μ long, palmate. —— Main skeleton a loose reticulum with squarish meshes, the side commonly formed by a small fascicle of spicules. Continuous bundles more or less radial to the surface, distinguishable as in type.

Station 3384, two specimens.

The body (Fig. 4, Plate 20) is plate-like, 5 to 8 mm. thick, but not very flat; the plate somewhat bent here and there, and with both surfaces made uneven by irregular depressions and elevations. Both specimens are fragmentary, but include a part of the natural free edge of the sponge. This is rounded off alike toward the two surfaces, and bears several large oscula, which are somewhat elongated in the horizontal plane of the sponge body, measuring in this plane 4 to 6 mm. These large oscula lead into efferent canals of corresponding width, which are about 10 mm. deep, passing inward in the horizontal plane of the body. Other smaller, rounded oscula, 1.5 to 2 mm. in diameter, are also present on this edge.

There is no discoverable difference between the two surfaces, which to the eye appear porous. The color is dark brown, and the sponge very fragile, owing to its great brittleness.

Collenchyma is found in some abundance at the surface in the shape of small, irregular, and vaguely defined areas, which in the uninjured sponge are inconspicuous, although evident in preparations. As in the other species of the genus, the skeletal reticulum is absent from such areas. In the intervening regions constituting the greater part of the surface, the skeletal reticulum lies beneath the dermal membrane in the usual way.—— Preparations of the surface show that there is no constant relation between the superficial collenchymatous areas and the presence of oscula. The latter, measuring commonly 300–500 μ in diameter, and occasionally reaching a diameter of 2 mm., are scattered abundantly over the surface, and occur both in the collenchymatous areas and in the intervening regions. Smaller apertures of all sizes, from 35 μ to 300 μ in diameter, are also scattered abundantly over the whole dermal membrane. The smaller are doubtless pores. It is not, however, possible in this sponge to distinguish, by their morphological characteristics alone, the smallest oscula from the larger pores, since there is such a perfect intergradation in size, and since the oscula and pores are both irregularly scattered.

The flagellated chambers in the present condition of the specimens vary in diameter from 24 to 32 μ. Some are spheroidal, others markedly compressed. Their arrangement indicates them to be eurypylous.

Spicules. Megascleres. 1. Style, Fig. 10, Plate **20**. Spicule about cylindrical, slightly curved, very sparingly spinose throughout its length; pointed end sometimes rounded. Size, 440 μ x 20 μ.

2. Subtylote, Fig. 11, Plate **20**. Spicule very slightly, sometimes not, enlarged at the ends; smooth, except at the extreme end, where it is feebly spinose. Size, 315 μ x 8 μ.

Microscleres. 3. Bipocillus 16–20 μ long, Plate **20**, Fig. 2, *a, c, d.* The curved axis terminates at one end in 2 or 3 pointed teeth, which project toward the opposite extremity. At the other end the axis terminates in a thin plate-like expansion with spherical curvature, divided by one or two narrow incisions into 2 or 3 lobes. Axis has a ventral keel, which disappears toward the toothed end. On each side of the keel, axis thins away, forming a lateral flange, which is sharply marked off from the terminal lobe of that side by a rounded incision.

4. Anisochela 12–20 μ long, Plate **20**, Fig. 2 *b.* Spicule of the palmate type, with a little spine at the small end.

Skeletal Arrangement. The main skeleton (Fig. 1, Plate **24**, a section vertical to surface, and extending from the surface to one of the large efferent canals. The right margin of figure represents surface of sponge. The left margin represents the canal wall) is a reticulum, formed of spinose styles. The reticulum is loose; meshes commonly squarish, though often subdivided obliquely into triangular meshes. Side of mesh equals length of spicule, and is commonly formed by several spicules (2, 3, 4, or even more), making a loose bundle. Continuous bundles, or tracts, more or less radial to the surface, are distinguishable. In places the reticulum might be described as made up of these tracts, with transverse connectives. At the angles of the meshes the spicules are united by spongin.

The dermal skeleton consists of the superficial layer of the main skeletal reticulum, and of abundant subtylotes. The latter are scattered without order, singly and in loose fascicles, both in the collenchymatous areas of the ectosome and in those parts directly supported by the skeletal reticulum.

The microscleres occur in the dermal membrane, in the walls of the larger canals, and in the parenchyma in general. They are only fairly abundant.

Comparative. The sponge just described closely resembles *Iophon chelifer* Ridley and Dendy (1887, p. 119). The bipocilli are not only chelate, but in general shape and in size are nearly identical with those of the latter species. The skeletal reticulum in both forms shows vaguely developed fibres, which extend more or less radially to the surface. The spinose styles and tylotes are of about the same size in the two forms.

Ridley and Dendy describe *Iophon chelifer* as "amorphous, massive, honeycombed," and add, "Exact form uncertain, specimen fragmentary." The "Challenger" specimens were taken lat. 35° 4′ S., long. 18° 37′ E., off the Cape of Good Hope; lat. 46° 41′ S., long. 38° 10′ E., off Prince Edward Island; lat. 46° 55′ S., long. 51° 52′ E., between Prince Edward and Kerguelen Islands; the depth varying from 150 to 550 fath.

I have examined the type specimens of *I. chelifer*, and I find that although they are amorphous there is some reason for regarding them as thin plates which, because of the irregular character of the growth, have assumed an amorphous character. Actually, however, they differ markedly in appearance from *I. chelifer ostia-magna.* While the skeletal resemblances between my subspecies and the type are very close, the chelate character of the bipocillus cannot be regarded as a feature indicative in itself of species-relationship, since in the very different *Iophon lamella*, the bipocilli are also chelate.

Lambe has recorded *Iophon chelifer* R. and D. from the Pacific coast of Canada (1893, p. 30), and from several localities off the Atlantic coast of Canada (1896, p. 191; 1900, p. 23). Lambe's specimens differ in habitus from mine, being "amorphous and honeycombed," or massive, perforate, and consisting "of an inosculation of short, stout, irregularly shaped, nodose branches, which coalesce, frequently to such an extent as to become amorphous" (1893, p. 30).

Iophon lamella, sp. nov.

Plate 20, Figs. 3, 7–9, 12, 13. Plate 24, Figs. 2–4.

Diagnosis. Body lamelliform, 5 to 12 mm. thick. Efferent canals, 1–2 mm. in diameter, open in abundance over both surfaces. The surfaces, upper and lower, are in a measure differentiated. Pores irregularly scattered throughout the dermal membrane, wherever it overlies the skeletal reticulum. *Spicules.* 1. Spinose style, 210–220 μ x 12–16 μ. 2. Tylote, 220–240 μ x 7–8 μ, ends minutely spinose. 3. Chelate bipocillus, 12–16 μ long; terminating at small end in two pointed teeth, at larger end in a bilobed plate. 4. Anisochela, 14–28 μ long, palmate. Main skeleton a uniform reticulum of spinose styles. Meshes commonly triangular. Side of mesh formed by 1, 2, 3, or occasionally more spicules.

Station 3405, five specimens.

The sponge body is lamellar but irregularly thickened, and sometimes considerably curved; the free edge not possessing special characters distinguishing it from the rest of the surface. The thickness varies from 5 to 12 mm.; greatest width, about 50 mm. The sponge is firm, and while easily broken is not especially brittle. The color is a light yellowish-brown. The upper surface of a specimen is shown in Fig. 12, Plate **20**, and the lower surface of the same specimen in Fig. 13, Plate **20**.

The surfaces of the plate-like body are in a measure differentiated. The one surface, designated as the upper, is more even and in general of a lighter color. The other surface, regarded as the lower, exhibits shallow, irregular, and large concavities, as if here moulded over an underlying object.

The appearance of the surface is extremely variable, although there is an underlying uniformity of character. This appearance is largely determined by the character of the main efferent canals, which conditions the arrangement of the oscula and superficial collenchyma. The main efferent canals are numerous, cylindrical, and pass radially into the body from both surfaces. The diameter does not exceed 2 mm., and commonly is 1 to 2 mm. The canals penetrate deeply into the body, and in many cases *pass completely through the body from one surface to the other.* The oscula are sometimes single apertures, but often the end of the canal is covered in by a fenestrated membrane, including a few, 3 or 4, apertures. When the canal passes completely through the body, at least one end seems always to be covered in with a fenestrated membrane.

Near the lower surface of the sponge several canals, which open independently on the upper surface, may unite and thus produce a *vestibular space* which is separated from the exterior only by the dermal membrane of the lower surface. Such vestibular spaces are abundant in some specimens on those parts of the lower surface which seem to have been moulded over an underlying object (Fig. 13, Plate **20**), and here appear as depressed membranous areas, which are usually elongated, often somewhat meandering. (In the figure they appear darker, the more solid sponge tissue between them reflecting the light better — the sponge being immersed.) They open by oscula, in the case of the larger spaces by several, which range from a small size to a diameter of 2.5 mm. In these specimens the vestibular spaces are found only on the lower surface.

The common type of osculum, represented by the single apertures or fenestrated membranes of the canals which open independently on the surface, is in some regions not surrounded by collenchyma (Fig. 12, Plate **20**), in other regions is so surrounded (Fig. 3, Plate **20**). The oscula again may not be depressed (middle part of Fig. 12, Plate **20**), or may be markedly depressed (Fig. 3, Plate **20**). The oscula, and associated canals, may in one portion of a specimen be so numerous as to honeycomb the sponge (left of Fig. 12, Plate **20**), and in another region (middle of same figure) be comparatively far apart. The oscula are in general more abundant on the upper surface.

In two of the specimens large parts of both surfaces present a striking modification, which may be referred to as the reticulate modification. In these regions the surface is comparatively smooth and exhibits collenchymatous areas of a rounded, polygonal shape and 1 to 2 mm. in diameter, separated by narrower tracts of the more solid sponge tissue (Fig. 2, Plate **24**). A small osculum, about 0.5 mm. in diameter, lies in the centre of the area, and this is surrounded by a few other, usually smaller, apertures, or by the ends of canals abutting against the dermal membrane and appearing as apertures. The oscula lead into canals of corresponding size which penetrate, radially or obliquely, deep into the body of the sponge, where they continue to be surrounded with collenchyma as at the surface. The mass of collenchyma surrounding the main efferent canal, as may be seen in sections taken vertically to the surface of the sponge (Figs. 3 and 4, Plate **24**, sections passing entirely through the lamellate body), passes through the body from one surface to the other, and is honeycombed by numerous smaller canals. The main efferent canal itself, on the other hand, which is well shown in the middle of the microphotograph, Fig. 3, Plate **24**, does not appear to pass through the entire thickness of the body. The collenchymatous tracts both at the surface (Fig. 2, Plate **24**) and in the interior (Figs. 3 and 4, Plate **24**) lack the skeletal reticulum, which everywhere permeates the intervening regions.

The kind of structure, which has just been described, is obviously to be regarded as a modification brought about by the excessive development of collenchyma round the main efferent canals, coupled with the diminution in diameter of these canals. The specimens exhibiting the reticulate modification are elsewhere like the other individuals, the body being penetrated by the common larger type of efferent canal, the surface appearing uneven, uniformly dense, without obvious collenchyma, and showing irregularly scattered oscula about 1 mm. in diameter.

The pores, measuring 60–150 μ in diameter, are scattered irregularly but thickly on both surfaces of the body over the solid tissue intervening between the oscula, vestibular spaces, or the reticulately arranged collenchymatous areas. The flagellated chambers have a shrivelled appearance due doubtless to the faulty preservation. They now measure about 20 μ in diameter, and their arrangement indicates them to be eurypylous.

Spicules. Megascleres. 1. Style, 210–220 μ x 12–16 μ, Fig. 8, Plate **20**. Spicule nearly cylindrical, slightly curved, spinose with small sharp prickles. The prickles are more abundant near the ends, less abundant in the middle. The extreme point is smooth. Rounded end and spinose region near the point sometimes slightly dilated.

2. Tylote, 220–240 μ x 7–8 μ, Fig. 9, Plate **20**. Spicule slightly

thicker in the middle, tapering toward each end. Heads small, minutely spinose over distal half. Frequently one or two prickles on shaft, close to ends. Precise character of end varies: end commonly enlarged and rounded, but sometimes enlarged and irregular; sometimes not enlarged.

Microscleres. 3. Bipocillus, 12–16 μ long, Fig. 7 *a* and *c*, Plate **20**. Curved axis shows a thickened median keel, which disappears toward small end of spicule. On each side of keel, axis thins away, forming a lateral flange which is sharply separated by a rounded incision from the terminal plate. Axis terminates at one end, the larger, in a thin plate-like expansion which has a spherical curvature, and is divided by a narrow median incision into two lobes. At the other end axis terminates in two pointed teeth, which project toward the larger end.

4. Anisochela, 14–28 μ long, Fig. 7 *b*, Plate **20**. The smaller sizes are the commoner. Spicule of palmate type; a little spine at the smaller end.

Skeletal Arrangement. Main skeleton a uniform reticulum of spinose styles. Meshes are commonly triangular, but the shape may be construed as due to the fact that a spicule or a small fascicle of spicules extends obliquely across a *squarish* mesh, acting perhaps as a brace. Side of mesh equal to length of a spicule and formed by 1, 2, 3 or occasionally more spicules. At the corners of the meshes the spicules are united by masses of spongin, which is colorless.

Dermal skeleton consists of the outermost layer of the skeletal reticulum, and of scattered tylotes. The latter are frequently found in loose fascicles or tracts, and occur throughout the dermal membrane.

The microscleres are present in the dermal membrane, and in the parenchyma. They are very abundant in the walls of many of the canals.

Iophon lamella indivisus, subsp. nov.

Plate 20, Figs. 14-16.

Diagnosis. Sponge distinguished from the type by the character of the bipocillus, which is not chelate. Bipocillus, 8–10 μ long, terminating at the large end in a curved plate of rounded outline, which is ordinarily not divided, terminating at the other end in a smaller plate with denticulate margins.

Station 3405, 6 specimens.

Along with the specimens of *Iophon lamella* were taken six other specimens, four of which are fragmentary, having the same plate-like habitus and the same general arrangement of the canals. The skeleton too is similar to that of *I. lamella* except in the matter of the bipocilli.

The upper surface of a specimen is shown in Fig. 16, Plate **20**, and the lower surface of the same in Fig. 14, Plate **20.** The efferent canals as in the type pass into the body from both surfaces, sometimes passing through from one surface to the other. As in the type the upper surface is lighter in color, and bears more numerous oscula than the lower surface. On the lower surface elongated vestibular spaces are extensively developed, appearing as furrows lined with smooth membrane. The flagellated chambers are of the same size as in the type.

The two good specimens differ from the type as regards the detailed appearance of the upper surface. The point is doubtless one of individual difference, and in the remaining specimens could not be determined. In these two specimens the upper surface bears abundant depressions, many of which are furrow-like. The efferent canals open in the depressions (Fig. 16, Plate **20**). Here and there several efferent canals, instead of opening separately, unite beneath the dermal membrane of this surface to form a vestibular space, essentially similar to those which are more conspicuously developed on the lower surface.

Skeleton. The *megascleres,* styles, and tylotes, are like those of the type, and the skeletal arrangement offers no points of difference.

Microscleres. 1. Bipocillus, 8–10 μ long, Plate **20**, Fig. 15, *a, c, d, e, f.* The curved axis terminates at one end in a thin plate-like expansion having a spherical curvature and a rounded outline. This is usually undivided, but occasionally spicules are found in which it is divided by a deep median incision into two lobes, as in *I. lamella.* At the other end the axis terminates in a smaller curved plate, which is pointed, and in which the free edge on each side of the terminal point is minutely denticulate. Axis itself, near the larger end of the spicule, flattens out on each side, forming a thin lateral flange, which is separated from the terminal plate by a rounded incision. The spicule is scantily present in the parenchyma, more abundant in the dermal membrane.

2. Anisochela, 12–28 μ long, Plate **20**, Fig. 15 *b.* Spicule does not differ from anisochela of the type, and is scantily present in the dermal membrane and parenchyma.

Comparative. The chelate character of the bipocillus makes a striking point of resemblance between *Iophon lamella* and *Iophon chelifer* R. and D.

But when a comparison is made between the three forms *I. chelifer ostiamagna*, *I. lamella*, and *I. lamella indivisus*, it becomes obvious that the chelate character is in itself not a guide to relationship. On the one hand, two sponges (*I. chelifer* and *I. lamella*) may occur which differ widely in most respects, but agree in having the chelate bipocillus. While on the other hand two sponges (*I. lamella* and *I. lamella indivisus*) occur agreeing in most particulars, but having the one chelate, the other non-chelate bipocilli.

Iophon indentatus, sp. nov.

Plate 19, Fig. 6; Plate 20, Figs. 1, 5, 6; Plate 23, Fig. 4.

Diagnosis. Sponge incrusting, 2–3 mm. thick, fragile, of brown color. Surface indented with polygonal collenchymatous depressions 0.5 to 1 mm. in diameter, separated by narrower ridges of more solid skeletogenous tissue. Oscula, 150–200 μ in diameter, occupy the centres of the depressions. Pores, 75 μ in diameter, scattered over the ridges. *Spicules.* 1. Spinose style, 220 μ x 14–16 μ. 2. Subtylote, 220 μ x 8 μ, minutely spinose at extreme ends. 3. Bipocillus, 8 μ long; smaller end, a curved plate with denticulate margins; larger end, an undivided curved plate of a rounded outline. 4. Anisochela, 14 μ long, palmate. Main skeleton a uniform reticulum of spinose styles. Side of the squarish or triangular mesh formed by 1, 2, or occasionally 3–4 spicules.

Station 3405, 3 specimens.

The sponges are all incrusting upon a *Gorgonia.* The incrustation is 2 to 3 mm. thick, extending in places in the shape of sheets which occupy the axils of the *Gorgonia* branches. The color is a rather light brown. Sponge fragile, easily torn and broken.

The surface (Fig. 1, Plate **20**) is indented with collenchymatous depressions of a polygonal or rounded polygonal outline, 0.5 to 1 mm. in diameter. These depressions, which appear to the eye translucent and gelatinous, are separated by considerably narrower ridges composed of the more solid sponge tissue. A small osculum, 150 to 200 μ in diameter, lies about in the centre of an area, and in some areas is surrounded by a few other smaller apertures. Between the collenchymatous areas, over the surface of the ridges, abundant pores measuring about 75 μ in diameter are irregularly scattered. The surface resembles that of the smooth, reticulate portions of *Iophon lamella* (Fig. 2, Plate **24**), but the collenchymatous areas are considerably smaller and less sharply limited than in the latter species.

The oscula lead into main efferent canals which penetrate deeply into the interior of the sponge, where they continue to be surrounded by a thick layer of collenchyma. The canals are of about the same diameter as the oscula. Some of them are, throughout the thickness of the sponge, radially directed to the surface, but more are obliquely inclined, often curving so that a section which is vertical to the surface of the sponge cuts them transversely. This is the case in Fig. 4, Plate **23**, which represents such a section taken through the *Iophon* and a part of the underlying *Gorgonia* axis.

The collenchyma surrounding a main canal in the sponge interior forms a roughly cylindrical tract traversed by the canal, and preserving approximately the diameter which it has at the surface of the sponge. These tracts cut the sponge body up into intervening regions permeated throughout their extent by the skeletal reticulum, which does not extend into the collenchymatous tracts themselves. The parts of the body permeated by the skeletal reticulum may be thought of as partitions between the collenchymatous tracts. These partitions more commonly have a thickness less than the diameter of the collenchymatous tracts, appearing in sections as thin trabeculae, as in Fig. 4, Plate **23**. Elsewhere, however, in the same specimen the skeletogenous partitions may appear as thick masses. As regards the arrangement of the main canals and the relative disposition of skeletogenous and collenchymatous tracts in the sponge interior, there is much resemblance between this species and the reticulate specimens or parts of specimens of *I. lamella*, but in the latter the main canals are more frequently radially directed, and both the collenchymatous tracts and intervening skeletogenous portions are thicker and probably on this account appear better defined in sections (Plate **24**, Figs. 3 and 4).

Spicules. Megascleres. 1. Style, 220 μ x 14–16 μ, Plate **20**, Fig. 5. Spicule spinose with small, sharp prickles, which are stronger and more numerous near the ends. Extreme point smooth. Slightly curved, nearly cylindrical, very slightly enlarged at rounded end and near the point.

2. Subtylote, 220 μ x 8 μ, Plate **20**, Fig. 6. Very slightly, scarcely at all, curved. Tapering a little from the middle toward ends, which are scarcely enlarged and most minutely spinose. Shaft in general smooth, but near the ends are a few scattered prickles.

Microscleres. 3. Bipocillus, 8 μ long, Plate **19**, Fig. 6 *b, c, d, e*. Curved axis at the smaller end terminates in a spoon-shaped expansion with denticulate margins. This expansion at the extreme end sometimes appears rounded, and sometimes angular. The difference in appearance is probably due to a difference in position, and the end is probably always angular. Toward the other end the axis develops the usual thin lateral flange, beyond which there is the usual incision separating the flange from the large terminal plate with rounded outline and spherical curvature. The denticulate plate is sometimes nearly equal in size to the larger plate. In minute details the spicule differs from the very similar bipocillus of *I. lamella indivisus* (comp. Plate **20**, Fig. 15).

4. Anisochela, 14 μ long, Plate **19**, Fig. 6 *a*. Spicule, of the palmate type common in the genus, with a little spine at the smaller end.

Skeletal Arrangement. Main skeleton consists of a uniform reticulum of spinose styles. Meshes squarish or triangular. The side of a mesh is equal to the length of a single spicule, and is formed by one, two, or occasionally three or four spicules. Spicules at the corners of the meshes are united by spongin.

Dermal skeleton consists of the superficial layer of the skeletal reticulum and of abundant subtylotes, which are scattered irregularly, often in loose tracts.

The microscleres are abundant in the dermal membrane; also present in considerable abundance throughout the parenchyma, especially in the walls of, and in the tissue immediately surrounding, the larger canals.

Comparative. Ridley and Dendy combine (1887, p. 117), under the name of *Iophon pattersoni* (Bwk.), a number of previously described species, and record under this head specimens taken by the "Challenger" off the coast of Patagonia and Tristan da Cunha. All of these forms have palmate anisochelae with pointed smaller ends, up to 30 μ long, and minute bipocilli. *Iophon indentatus* must be very similar, judging from Bowerbank's figures, in surface appearance to one of the species combined, *viz.*: *Halichondria nigricans* Bwk. (Bowerbank, 1866, pp. 266–68; Bowerbank, 1874, Plate XLV. Fig. 25) which occurs as a "massive" body and also incrusting. I have examined type specimens in the British Museum of this and the other Bowerbank *Iophons*, but the specimens are dried and old, and no longer permit the character of the surface and the canal arrangement to be studied. According to Ridley and Dendy (*l. c.*, p. 118) in *Halichondria nigricans* the spined styles measure 218 μ x 8 μ, the tylotes 195 μ by 3 μ, and are thus much slenderer than in *I. indentatus*.

Iophon indentatus also resembles in surface appearance *Alcbion proximum* Ridley (Ridley, 1881, p. 114), another of the species combined by Ridley and Dendy. But the styli here are 158 μ x 9 μ, and thus much smaller than in my sponge. Moreover, the skeletal reticulum is described as composed of primary fibres, five to six spicules thick, running from the base to the surface and crossed by secondary bars approximately at right angles, — an arrangement not found in *I. indentatus.*

The "Challenger" specimens of *Iophon pattersoni* R. and D., which I have examined, differ markedly in surface appearance from my form. They are, as Ridley and Dendy describe them, massive and amorphous. I may add that they are honeycombed with comparatively large canals, which open over the whole surface. The spines and tylotes (R. and D., 1887) are considerably slenderer than in *I. indentatus.* On the other hand, I find the bipocilli are of about the same size as in my form, and have a similar shape, the smaller end being denticulate. But this point of resemblance probably means little, since minute bipocilli with denticulate small end also occur in *Iophon radiatus* Topsent (Topsent, 1901 *a*, p. 22, Plate III. Fig. 13) and in *Iophon lamella indivisus.*

Topsent (1892 under *Dendoryx* (*Iophon*) *nigricans* Bwk.) criticises *Iophon pattersoni sensu* Ridley and Dendy, and is disposed to regard it as a heterogeneous group, on the score that some of the forms which Ridley and Dendy combine, and which have been taken several times, are readily distinguishable. I must say that I find the published data for the union of these several forms inadequate. I therefore designate my sponge as a new species, although *Iophon pattersoni* as conceived by Ridley and Dendy is probably comprehensive enough to include it.

AXINELLIDAE Ridley and Dendy.

Phakellia Bwk.

1864. *Phakellia* Bowerbank, 1864, p. 186.
1880. *Phakellia* Bwk., O. Schmidt, 1880, p. 81.
1887. " " Vosmaer, 1887, p. 341.
1887. " " Ridley & Dendy, 1887, p. 169.
1894. " " Topsent, 1894*a*, p. 25.
1896. " " Dendy, 1896, p. 235.
1897. " " Lendenfeld, 1897, p. 114.

Phakellia lamelligera, sp. nov.

Plate 18, Fig. 10; Plate 19, Figs. 2, 3; Plate 25, Figs. 1, 3, 4.

Diagnosis. Sponge body a cup with much-fluted wall, fluting increasing toward margin of cup. Wall of cup lamellate, 2–3 mm. thick, strongly hispid on both surfaces. Color light brown.—— Inner or oscular face of cup studded with oscula 300–500 μ in diameter and about 1 mm. apart. Outer or pore surface studded with rounded pore-membranes 300–500 μ in diameter and about 1 mm. apart. Main afferent and efferent canals alike, 300–500 μ wide, and passing radially into the lamella from the oscula and pore-membranes, respectively. —— *Spicules.* 1. Oxea, 540 x 32 μ. 2. Style, 400 x 30 μ. 3. Style, 1275 x 28 μ. Skeletal framework a continuous reticulum made up of spiculo-fibres which have the shape of flattened bands or lamellae extending at right angles to the surfaces of the sponge.

Station 3368, 1 specimen.

Sponge body (Fig. 3, Plate **19**) is a folded lamella which has assumed the shape of a cup with a fluted wall. Cup is compressed from side to side, and is thus wider in one horizontal axis than in the others. The folds increase in extent from the base toward the free edge. Below, the cup narrows to a base which is composed of two short irregular peduncular portions, situated close together. Total height of cup, 63 mm.; greater horizontal diameter, 110 mm.; smaller horizontal diameter, 55 mm. Thickness of lamellar wall in lower part of cup, 3 mm. Wall is thinner above, about 2 mm. thick just below the free edge. Edge itself is comparatively sharp. Both inner and outer surfaces of the cup are hispid with closely set styles, which project about 1 mm. beyond the surface. Consistency firm, but sponge easily broken. Color, light brown.

The two surfaces are much alike, although one, the inner, is probably the oscular, and one, the outer, probably the pore surface. From both surfaces numerous main canals 300–500 μ in diameter and about 1 mm. apart pass radially into the body. They penetrate deeply into the body, the canals of opposite surfaces interdigitating as in *Phakellia ventilabrum* (Ridley and Dendy, 1887, Plate XLIX. Fig. 3). The canals debouching on the inner surface, efferent canals, open for the most part by single oscula nearly as wide as the canals themselves, and bounded by a narrow rim of oscular membrane. Rarely, instead of a single osculum there is a fenestrated membrane, including two or three apertures. Between the oscula the dermal membrane of this surface is perforated by scattered apertures of small size, 75–150 μ in diameter, resembling pores in appearance. Such small apertures are in some places abundant.

The corresponding canals of the opposite surface, afferent canals, are roofed in by pore-membranes, which in some instances are perforated by from one to a few (3 or 4) pores. But in many cases the membranes are imperforate, the pores doubtless being closed. The open pores have a diameter ranging from 75 to 200 μ. The dermal membrane of this surface between the apertures of the large canals is doubtless, in the natural state, perforated by abundant, irregularly scattered, pores. At any rate very numerous short radial canals, 75–150 μ in diameter, abut directly against it. The circular areas of thin membrane covering in such canals are mostly imperforate, but in some cases show an open pore.

The flagellated chambers are rounded, 32–40 μ in diameter, and their arrangement in the sponge trabeculae indicates them to be eurypylous.

Spicules. 1. Oxea, 540 μ x 32 μ, with smaller sizes, Plate **19**, Fig. 2, *a*, *b*, *f*, *g*. Spicule may be nearly straight (*f*), strongly bent (*b*), slightly bent (*g*), or evenly and slightly curved (*a*). It is smooth and tapers from the middle to the moderately sharp or rounded points.

2. Small style, 400 μ x 30 μ at the base, Plate **19**, Fig. 2, *c*, *h*, *i*. Spicule is smooth and tapers evenly from rounded base to the sharp point. It may be straight (*h*), slightly bent near the base (*i*), or sharply bent near the base (*c*).

3. Large style, 1275 μ x 28 μ at the base, Plate **19**, Fig. 2, *d*, *e*. Spicule is smooth, and tapers evenly from rounded base to the sharp point. It may be nearly straight (*e*), or conspicuously bent (*d*).

Skeletal Arrangement. Wall of sponge is supported by a continuous skeleton, Plate **18**, Fig. 10, consisting of a reticulum of spiculo-fibres, which are flattened at right angles to the surface of the sponge, and thus have the character of bands or lamellae, Plate **25**, Fig. 1. The meshes are elongated in the direction of radii extending upward from the base toward the free edge of the sponge. Thickness of skeletal lamella (*i. e.* its narrower cross diameter), about 375 μ. Meshes of the reticulum frequently about 1800 μ x 500 μ. The reticulum may be regarded as a system of upwardly extending, branching fibres, the flat surfaces of which are connected together by anastomoses.

The flattened skeletal lamellae vary in character. They may extend nearly through the sponge wall from one surface to the other, or only a part of the way (Plate **25**, Fig. 1). The lamellae may be quite unbranched in the plane in which they are flattened (Plate **25**, Fig. 4), or they may be branched in this plane (Plate **25**, Fig. 3). In some cases the lamella is so branched as to be vaguely divisible into a main fibre and secondary fibres extending out from it to the surface. The lamellae in the upper part of the sponge are more commonly branched in the plane of flattening than is the case in the lower part of the body.

The skeletal lamellae are composed largely of oxeas (Spicule 1), closely packed and interlaced. From the general surface of the lamella project abundant short styles (Spicule 2), while from the edges of the lamellae that are adjacent to the surfaces of the sponge, numerous long styles (Spicule 3) project (Plate **25**, Figs. 1, 3, 4). It is these latter spicules which protrude beyond the surface of the sponge and give to the latter its hispid character.—— The spicules of a lamella are united together by pale spongin. The spicules and spongin do not form a continuous solid mass. Nevertheless the spicules are so crowded that only small rounded gaps are left unoccupied by either spicules or spongin.

The peduncular part of the sponge is occupied by a strong massive skeleton with which the skeletal lamellae are continuous. This peduncular skeleton has the same character as one of the skeletal lamellae. It consists of closely and irregularly strewn spicules, chiefly oxeas, so cemented together by spongin as to produce a nearly continuous mass, which is excavated only here and there by areolae. The spongin is more abundant than in the skeletal lamellae.

Comparative. The arrangement of the skeletal framework in this species is very different, although derivable from that in the well-known *P. ventilabrum* (Johnston). In the latter only the middle plane of the lamella, which may be 4 mm. thick, is occupied by the reticulum of longitudinal fibres. From these, long loose bundles of spicules pass radially to the opposite surfaces (Bowerbank, 1864, p. 367, Plate XXXIII.). In *P. lamelligera* a flattened skeletal lamella may be regarded as the equivalent of a longitudinal fibre, on which the radial outgrowths are so thick as to be continuous.

In *P. folium* O. Schm. from the Florida coast (O. Schmidt, 1870, p. 62), the entire thickness of the lamella is occupied by the reticulum of longitudinal fibres as in *P. lamelligera.* But the lamella is thin, about 1 mm. thick in the piece examined (from a specimen in the Museum of Comparative Zoölogy), and the spiculo-fibres are slender and not flattened. The spiculation in Schmidt's species is very similar to that of *P. ventilabrum.*

Auletta O. Schmidt.

1870. *Auletta* O. Schmidt, 1870, p. 45.
1882. *Auletta* Schm., Vosmaer, 1882, p. 41.
1887. " " Vosmaer, 1887, p. 341.
1889. " " Dendy, 1889, p. 92.
1894. " " Topsent, 1894 *a*, p. 25.

Auletta dendrophora, sp. nov.

Plate 19, Figs. 4, 5, 7; Plate 25, Fig. 2.

Diagnosis. Sponge arborescent, produced by the continued branching of an originally simple cylindrical body. Terminal branches, "persons," 5 mm. in diameter and 15–20 mm. high, with terminal oscula. Paragastric cavity cylindrical, about 1.5 mm. in diameter, and continuous throughout the colony. Obliquely branching radial canals extend from the paragastric cavity toward surface. Pores, irregularly scattered between the projecting tufts of spicules, open into subdermal chambers. Color, light yellowish brown. —— *Spicules.* 1. Strongyle, slightly curved once or oftener, commonly 400–600 μ x 18–20 μ. 2. Style, common size in longitudinal fibres, 600 μ x 22 μ; common size in radial fibres, 360 μ x 18 μ. 3. Style, 170 μ x 8 μ. Skeletal framework consists of longitudinal spiculo-fibres with transverse connectives, and of radial fibres, which extend from the longitudinal fibres to the surface, there ending in projecting tufts of spicules.

Station 3405, 2 specimens, one fragmentary.

The sponge, which may be regarded as a continually branching cylinder, consists of a short vertical stalk, above which the branches spread outward and upward, fusing with one another to a considerable extent over their lateral faces. In the perfect specimen (Fig. 7, Plate 19), the stalk is 10 mm. high and 8 mm. thick, and was obviously attached by its somewhat expanded and concave lower end. The total height of the specimen is 55 mm. and the greatest breadth 75 mm. From the apex of the stalk the branching has not extended symmetrically in all directions. If a vertical plane be passed through the stalk and the direction of greatest width, the branching will be found to have taken place in this plane and to one side of it, but scarcely at all toward the opposite side. The colony thus, when viewed from above, presents roughly a semicircular outline, and when viewed from the side, presents one flattened face, which is the face shown in the figure.

The growth is of such a character that a branch tends to produce several upright terminals, one after another, approximately in the same plane. This is much more marked in the case of some branches than in others. Where it is marked the partial fusion of the terminal branches over their lateral faces results in the formation of imperfect, vertical lamellae, which, however, are only indistinctly developed as such. The terminal branches are cylindrical, rounded at the free end, where there is a depression occupied in a few cases by an open, circular osculum, but in general by an oscular membrane, which in the present condition of the sponge is imperforate. When the osculum is widely open, it occupies the whole of the depression, and is 2 mm. in diameter. The oscular membranes doubtless represent closed oscula.

The terminal branches are about 5 mm. in diameter, and for the most part 15 to 20 mm. high. Their axial (paragastric) cavities, opening above by the terminal oscula, are continuous below with one another and with the axial cavity traversing the rest of the colony. This cavity throughout the colony has a fairly uniform diameter close to 1.5 mm. The wall of the colony is about 2 mm. thick, in some of the terminal branches thinning down to 1.5 mm.

Color, a very light yellowish brown inclining to ashy. The sponge is tough, firm, and in some measure compressible, flexible, and elastic. The surface is covered with the projecting tufts of spicules belonging to the radial spiculo-fibres. These are just perceptible with a lens, barely so to the touch.

The pores in general are closed, but in places are open. They are in such regions scattered abundantly and without regularity of arrangement over the dermal membrane between the projecting tufts of spicules, and measure 50 to 80 μ in diameter. The pores open into subdermal chambers which in large number underlie the dermal membrane. The subdermal chambers, when seen from the surface, present a lobulated appearance, owing to the fact that they consist of several spheroidal subdivisions freely connecting and often so arranged that the chamber itself is considerably elongated in the tangential direction. The width of the chambers is approximately the space between adjacent dermal tufts of spicules. In Fig. 5, Plate **19**, which represents part of a section radial to the surface, a characteristic subdermal chamber, *s. c.*, is shown, which has been cut lengthwise. It connects with a radially extending afferent canal.

Into the paragastric cavity radial efferent canals open, which lie between the radiating skeletal bundles. These canals, as they are traced toward the surface, branch obliquely. The rounded internal openings of the radial canals measure 250–425 μ in diameter, and are conspicuous in face views of the wall of the paragastric cavity (Plate **19**, Fig. 4). Flagellated chambers not recognizable. A small commensal annelid is present in the canals in the neighborhood of the surface of the sponge.

Skeletal Arrangement. The inner part of the sponge wall, next the paragastric cavity, is strengthened by a framework of spiculo-fibre, consisting of main longitudinal fibres 100–300 μ wide with slenderer connectives (Plate **19**, Fig. 4, face view of wall of paragastric cavity; Plate **25**, Fig. 2, longitudinal section through sponge wall). The longitudinal fibres give off branches, which extend radially through the sponge wall (Plate **25**, Fig. 2). The radial fibres themselves may branch once or twice before reaching the surface. They or their branches end in tufts of spicules, which project a short distance beyond the surface. The spicules of a fibre are united by a small amount of colorless spongin.

Spicules. *1. Strongyle* (Plate **19**, Fig. 4), curved once or oftener; smooth; usually but not always tapering slightly toward the rounded ends; degree of attenuation not always the same for the opposite ends of a spicule. Size, commonly 400–600 μ x 18–20 μ. Smaller sizes down to 280 μ x 12 μ, and larger sizes up to 800 μ x 20 μ are common. Exceptionally stout spicules, for instance, one measuring 714 μ x 26 μ, and exceptionally slender spicules, for instance, one measuring 680 μ x 14 μ, are sometimes met with.

This is the chief spicule in the longitudinal fibres and connectives. It is also present in the radial fibres, though here less abundant than the style. One or two of these spicules may sometimes be found passing between the deeper portions of the radial bundles, as feeble connectives.

2. Style (Plate **19**, Fig. 5), smooth, straight, or somewhat curved at the base, sharp-pointed; sometimes attenuated at the rounded end. Present in the longitudinal fibres, but not very abundant; here commonly about 600 μ x 22 μ, but larger forms up to 850 μ x 24 μ are found.

The style is the chief spicule in the radial fibres, projecting obliquely upward and outward from the fibre (Plate **25**, Fig. 2). At the end of the fibre styles project beyond the surface forming a tuft. The common size in the radial fibre is about 360 μ x 18 μ, although somewhat smaller ones and larger ones up to 730 μ x 20 μ are present.

3. Small style (Plate **19**, Fig. 4; Plate **25**, Fig. 2), commonly bent near the base. Rounded base of spicule may be either not attenuated or attenuated. Occasionally the base is pointed, the spicule thus becoming an oxea. Common size, about 170 μ x 8 μ.

The spicules project out at right angles from the longitudinal fibres and connectives, and from the deeper parts of the radial fibres. They are thus true echinating spicules, but not nearly so conspicuous as in the *Ectyoninae.* They are not present in great abundance anywhere, and transitions between them and the larger styles occur.

Comparative. The species just described is close to the type of the genus, *Auletta sycinularia* Schm. (O. Schmidt, 1870, p. 45, Taf. IV. Fig. 5) from the Florida coast, a specimen of which in the Museum of Comparative Zoölogy I have examined. In *A. sycinularia* the terminal branches are slenderer than in my species, and the wall much thinner. The wall is so thin that *the superficial radiating tufts of spicules arise directly from the longitudinal fibres,* there being no radial fibres, as in *A. dendrophora.* In the specimen examined, a typical terminal branch measures 2.5 mm. in diameter, and the wall is 0.5 mm. thick. The two species contain the same classes of spicules.

In habitus *A. dendrophora* exhibits a point of resemblance to *A. aurantiaca* Dendy (Dendy, 1889, p. 92, Plate V. Fig. 13) in that fusion occurs between the lateral surfaces of the terminal branches. But the fusion is slight in my species, whereas in Dendy's the fused branches form "lamellae like pan-pipes." The two species differ markedly as regards the skeleton. —— The lateral fusion of the branches is carried very far in what seems to be the first *Auletta* described, *viz.*: *Spongia lyrata* (Esper, Fortsetz, II. 42, tab. LXVII. Figs. 1, 2) from Ceylon. Esper's figures and the account of the skeleton given by Ehlers (1870, pp. 23, 31) indicate that this sponge is an *Auletta.* Ehlers provisionally places the sponge, which has styles and oxeas, in *Raspaigella* Schm. Lamarck (1813, p. 382), referring to Esper's sponge, says he has a specimen in his cabinet from the collection of M. Turgot, and gives with a query the Indian Ocean as the locality.

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Plate 26.

Plate 26.

Hydrographic Sketch of the Pacific, from the Gulf of California to Northern Ecuador, with the Track of the "Albatross," February 22 to April 23, 1891.

PLATE 1.

Plate 1.

Fig.	1.	*Hyalonema pateriferum.*	Spinose diact from marginal fringe; x 400.
"	2.	" "	Pinule from oscular (gastral) surface; x 400.
"	3.	" "	Dermal pinule; x 400.
"	4.	" "	Mesamphidisc; x 600.
"	5.	" "	Macramphidisc; x 400.
"	6.	" "	Macramphidisc; x 400.
"	7.	" "	Macramphidisc; x 400.
"	8.	" "	Micro-oxyhexact; x 600.
"	9.	" "	Micro-oxyhexact; x 600.
"	10.	" "	Amphidisc with 4-rayed umbels; x 400.
"	11.	" "	Amphidisc with 4-rayed umbels; x 400.
"	12.	" "	From a photograph; $\frac{1}{1}$.
"	13.	" "	From a photograph; $\frac{4}{10}$.

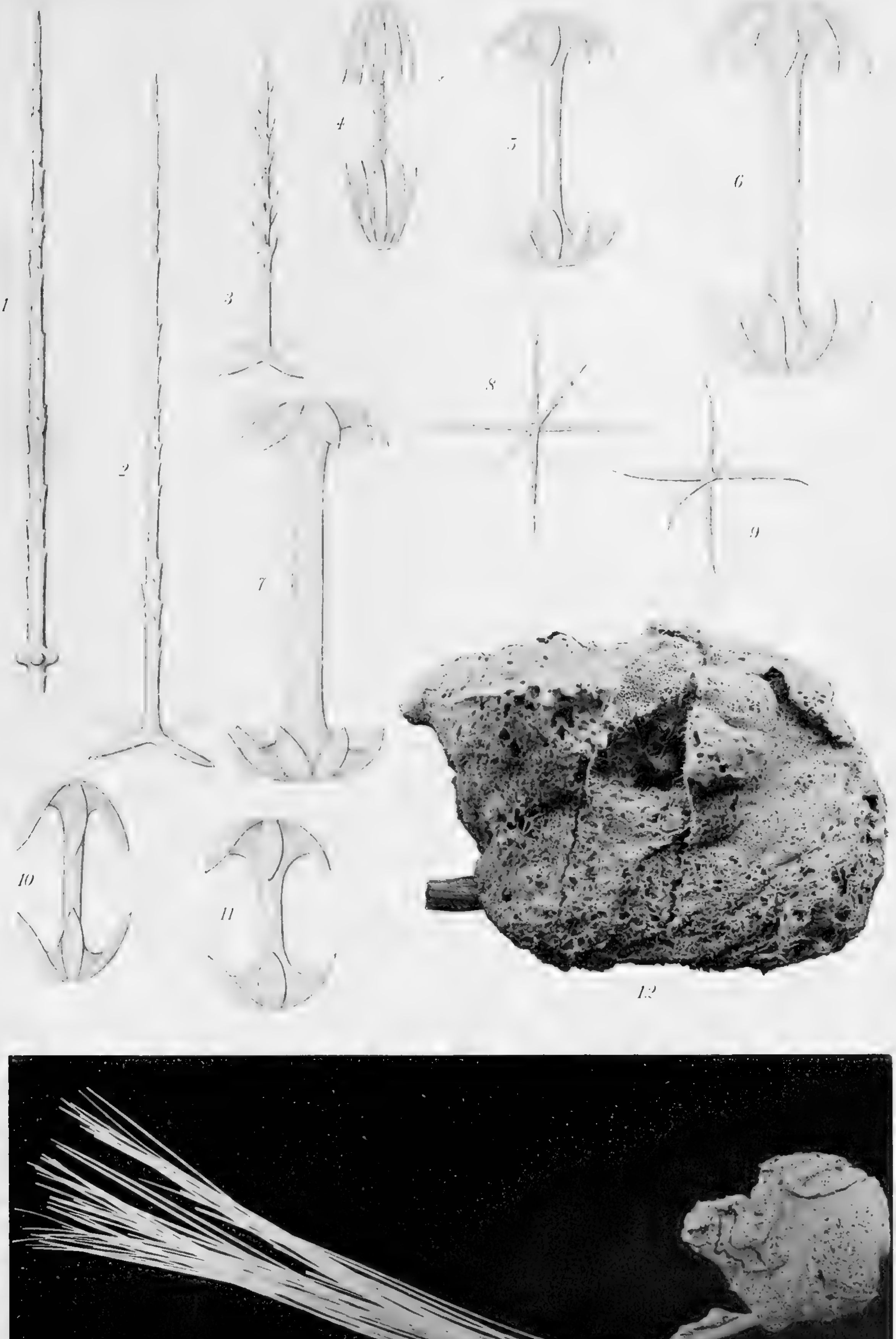

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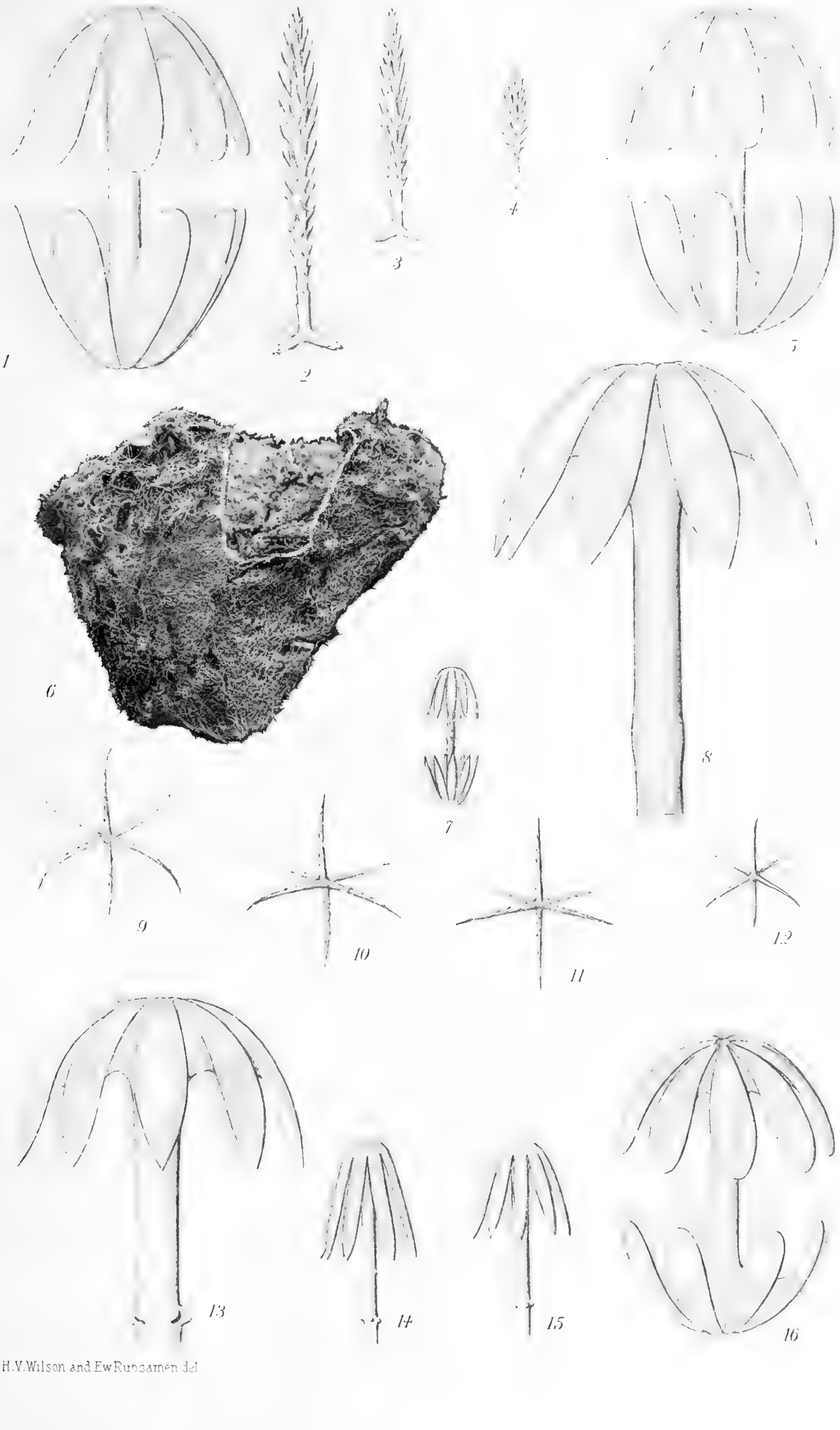
Plate 2.

Plate 2.

Fig. 1.	*Hyalonema bianchoratum.*		Macramphidisc; x 300.
" 2.	"	"	Dermal pinule; x 100.
" 3.	"	"	Dermal pinule; x 100.
" 4.	"	"	Dermal pinule; x 100.
" 5.	"	"	Macramphidisc; x 300.
" 6.	"	"	From a photograph; 1/1.
" 7.	"	"	Mesamphidisc; x 300.
" 8.	"	"	Macramphidisc; x 300.
" 9.	"	"	Micro-oxyhexact; x 300.
" 10.	"	"	Micro-oxyhexact; x 300.
" 11.	"	"	Micro-oxyhexact; x 300.
" 12.	*Hyalonema, sp.*		Micro-oxyhexact; x 300.
" 13.	"	"	Macramphidisc; x 300.
" 14.	"	"	Mesamphidisc; x 300.
" 15.	"	"	Mesamphidisc; x 300.
" 16.	"	"	Macramphidisc; x 300.



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Heliotype Co., Boston

PLATE 3.

Plate 3.

Fig. 1. *Hyalonema pedunculatum.* Micro-oxyhexact; x 600.
" 2. " " Macramphidisc; x 400.
" 3. " " Micro-oxyhexact; x 600.
" 4. " " Dermal pinule; x 400.
" 5. " " From a photograph. Lateral part of body sliced away on one side; $\frac{1}{4}$.
" 6. " " Mesamphidisc; x 600.
" 7. *Regadrella delicata.* Part of margin bounding oscular (sieve-plate) area, with adjoining lateral body wall. Dermal surface. The slender parenchymal diacts are represented, for the sake of clearness, as less numerous than in nature; x 14.
" 8. " " Another part of upper margin, with adjoining lateral wall. Dermal surface. Slender, parenchymal diacts omitted except near margin, and there represented as less numerous than in nature; x 45.

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PLATE 4.

Plate 4.

Fig. 1. *Caulophacus schulzei.* Unusual type of pinulus; x 150.

" 2. *Regadrella delicata.* Part of upper margin with adjoining lateral body wall. The slender parenchymal diacts of the body wall represented as less numerous than in nature; x 14.

" 3. *Caulophacus schulzei.* From a photograph. Upper body and stalk fastened together with pin; $\frac{1}{1}$.

" 4. *Euplectella, sp.* From a photograph. Lateral wall sliced away to show septa; $\frac{1}{1}$.

" 5. *Caulophacus schulzei.* Discohexaster; x 250.

" 6. " " Small type of discohexaster; x 250.

" 7. " " Pinulus from dermal surface; x 150.

" 8. " " Uncommon type of pinulus from gastral surface; x 150.

" 9. " " Pentact; x 70.

" 10. " " Pinulus from gastral surface; x 150.

" 11. *Regadrella delicata.* From a photograph. Dermal and gastral surfaces of lower part of body; dermal surface to the left; gastral surface to the right; $\frac{1}{1}$.

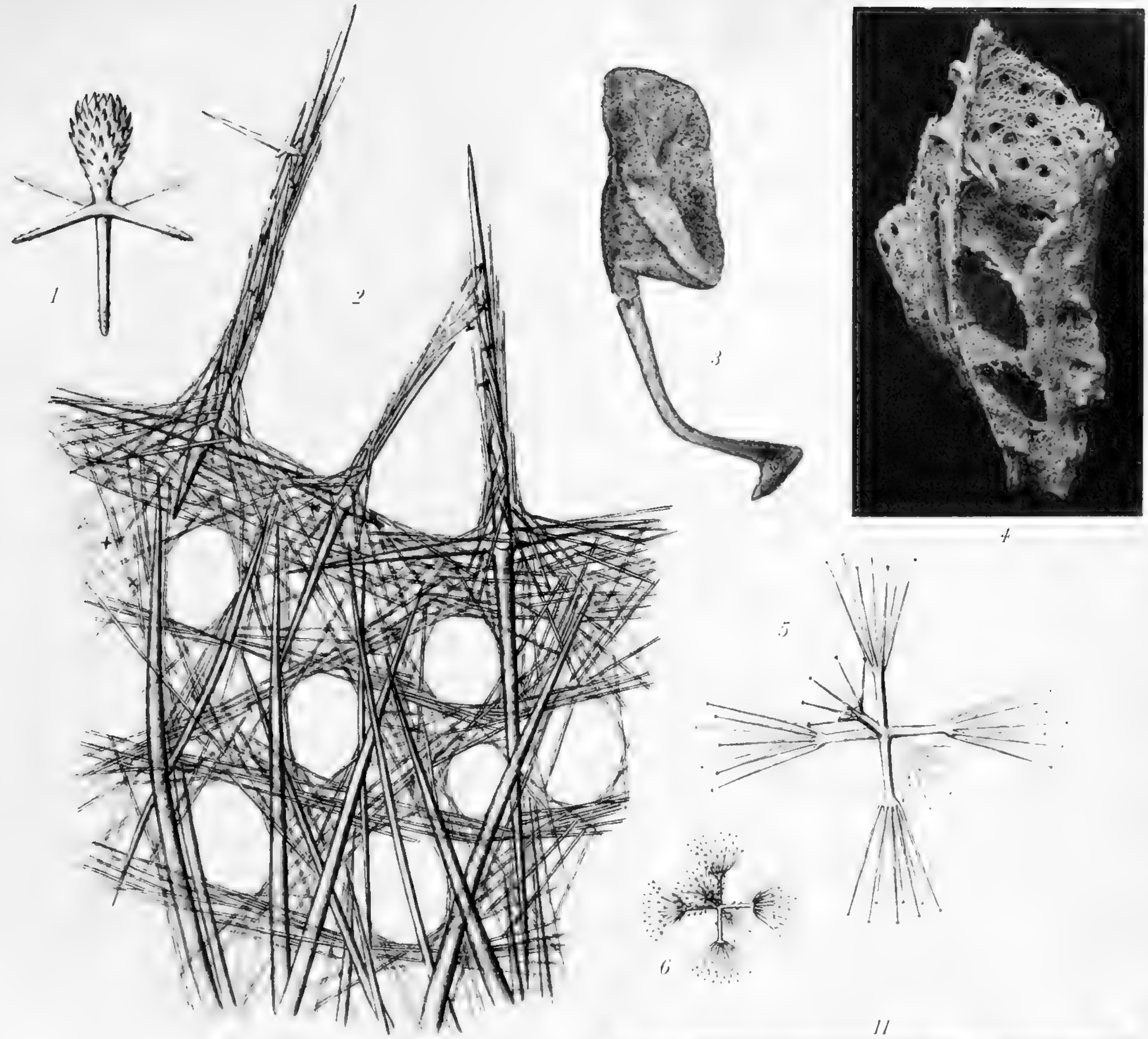

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Plate 5.

Plate 5.

Fig. 1. *Caulophacus schulzei.* Spinose discohexact with some bifid rays (*Discohemihexaster* of Schulze); x 250.

" 2. " " Discohexaster; a complete ray showing lateral branches; x 250.

" 3. " " Discohexaster; x 250.

" 4. " " Spinose discohemihexaster that nearly reaches condition of perfect discohexaster; x 250.

" 5. " " Spinose discohemihexaster; centrum and one principal ray with its branches; x 250.

" 6. " " Discohexaster; centrum and one complete ray; x 250.

" 7. *Caulophacus, sp.* Stalk attached to root spicules of *Hyalonema*. From a photograph; [illegible].

" 8. *Caulophacus schulzei.* Discohexaster; a complete ray, showing asymmetrical base on which the terminals rest; x 250.

" 9. " " Spinose discohemihexaster; x 250.

" 10. " " Radial section through body showing skeletal arrangement. Thickness of section permits only larger spaces to be seen. Gastral surface uppermost; x 20.

" 11. *Bathydorus levis spinosus.* From a photograph; [illegible].

" 12. " " " Oxyhexaster; x 300.

" 13. " " " Stauracts; x 300.

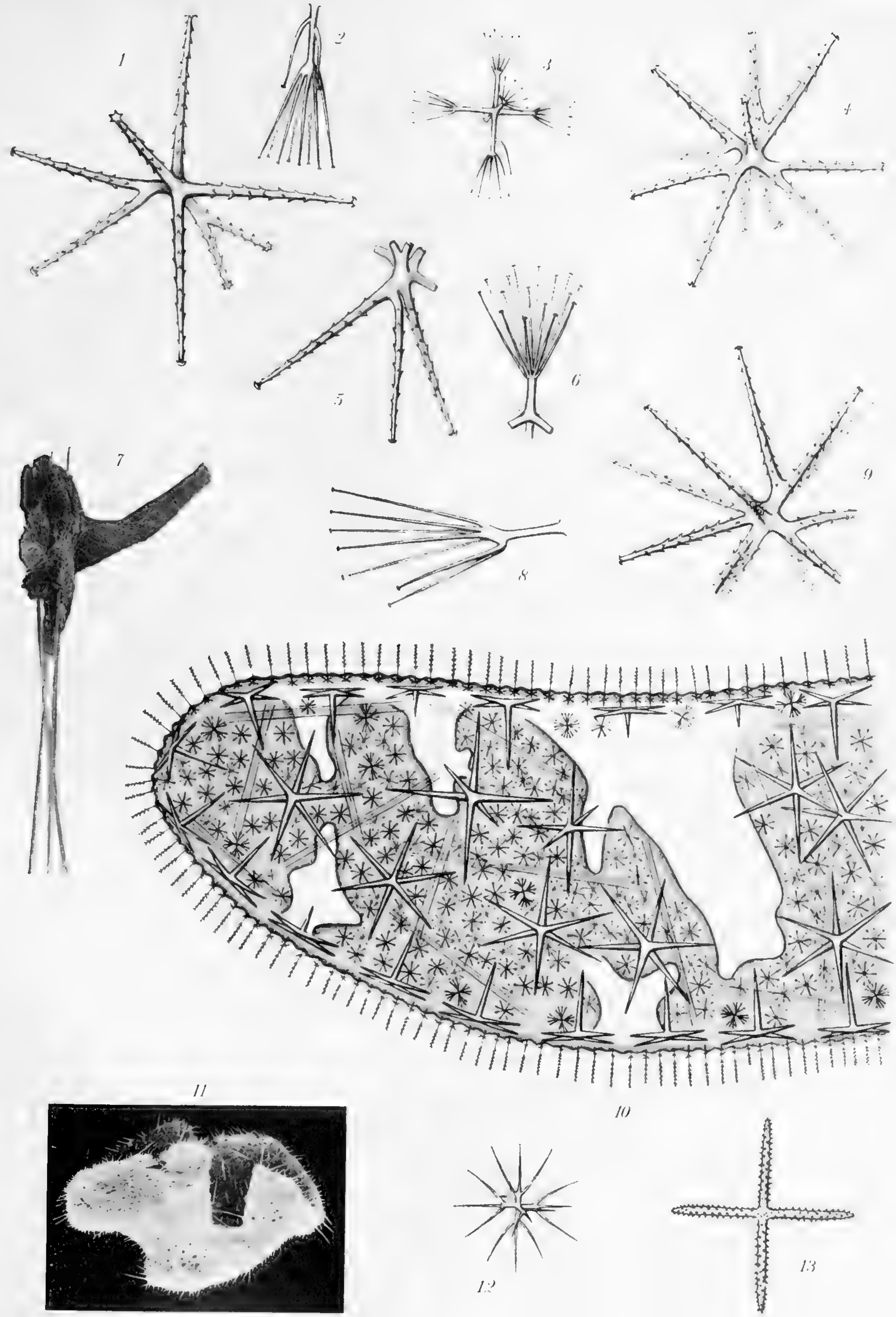

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Plate 6.

Plate 6.

Fig. 1. *Bathydorus levis spinosus.* From a photograph; $\frac{1}{1}$.
" 2. " " " Autogastral hexact; x 300.
" 3. *Farrea occa claviformis.* From a photograph; $\frac{1}{1}$.
" 4. *Staurocalyptus, sp.* Irregular discoctaster; x 300.
" 5. " " Paratropal, paratangential rays of prostal pentact; from above; x 100.
" 6. *Staurocalyptus, sp.* From a photograph; $\frac{1}{1}$.
" 7. " " Part of a paratropal ray of prostal pentact; x 400.
" 8. " " Discoctaster with two accessory rays; x 300.
" 9. " " Oxyhexaster; x 600.
" 10. " " Discoctaster; centrum and three rays; x 450.
" 11. *Farrea occa claviformis.* Uncinate; the two ends of same spicule; x 450.
" 12. " " " Gastral clavula; from above; x 450.
" 13. " " " Gastral clavula; lateral view; x 450.
" 14. " " " Gastral clavula; lateral view; x 450.

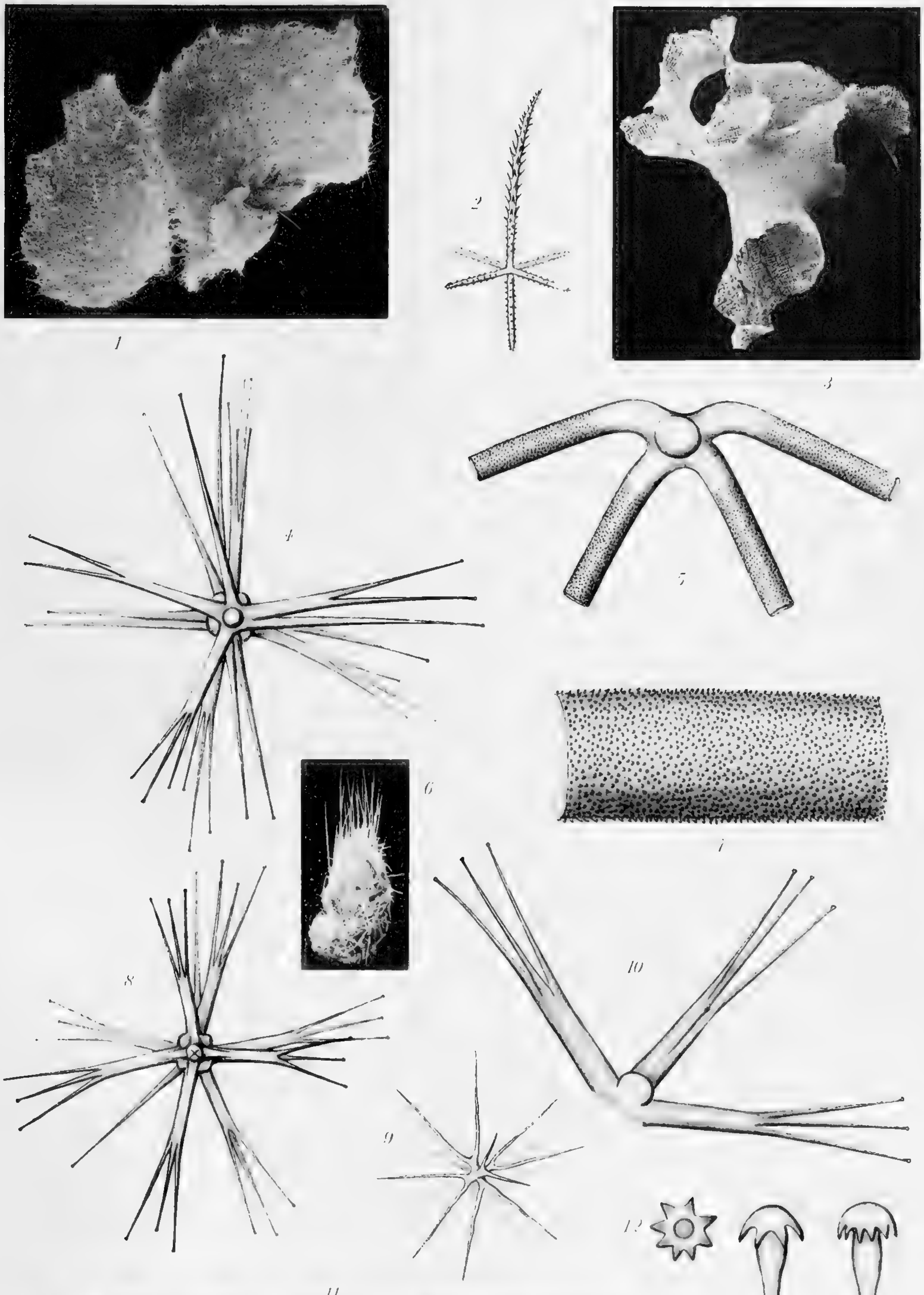
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PLATE 7.

Plate 7.

Fig. 1, *a*, *b*, *c*. *Farrea occa claviformis.* Gastral clavulae with degenerate teeth; x 450.

" 2. " " " Dermal pentact with clavulae; x 250.

" 3. " " " Gastral clavula; rare form; x 450.

" 4. *Farrea mexicana.* Gastral anchorate clavula; x 450.

" 5. " " " " " x 450.

" 6. *Farrea occa claviformis.* Gastral pentact with clavulae; x 250.

" 7. *Farrea mexicana.* From a photograph; ½.

" 8. " " Pentact with umbellate clavulae; x 250.

" 9. *Eurete erectum tubuliferum.* Part of surface view of sponge taken from the side. Axis of entire sponge about vertical. A completely bifurcated (tubular) lateral branch lies to the right, showing a tubular ridge, which marks the line along which the lips of the earlier, cup-like branch fused. A similar tubular ridge lies at right angles to the just-mentioned line of fusion, extending from the tubular branch on to axis of sponge. From a photograph; ½.

" 10. *Farrea mexicana.* Gastral anchorate clavula; x 450.

" 11. " " " " " ; from above; x 450.

" 12. *Eurete erectum tubuliferum.* From a photograph. Upper end of sponge, from above; ½.

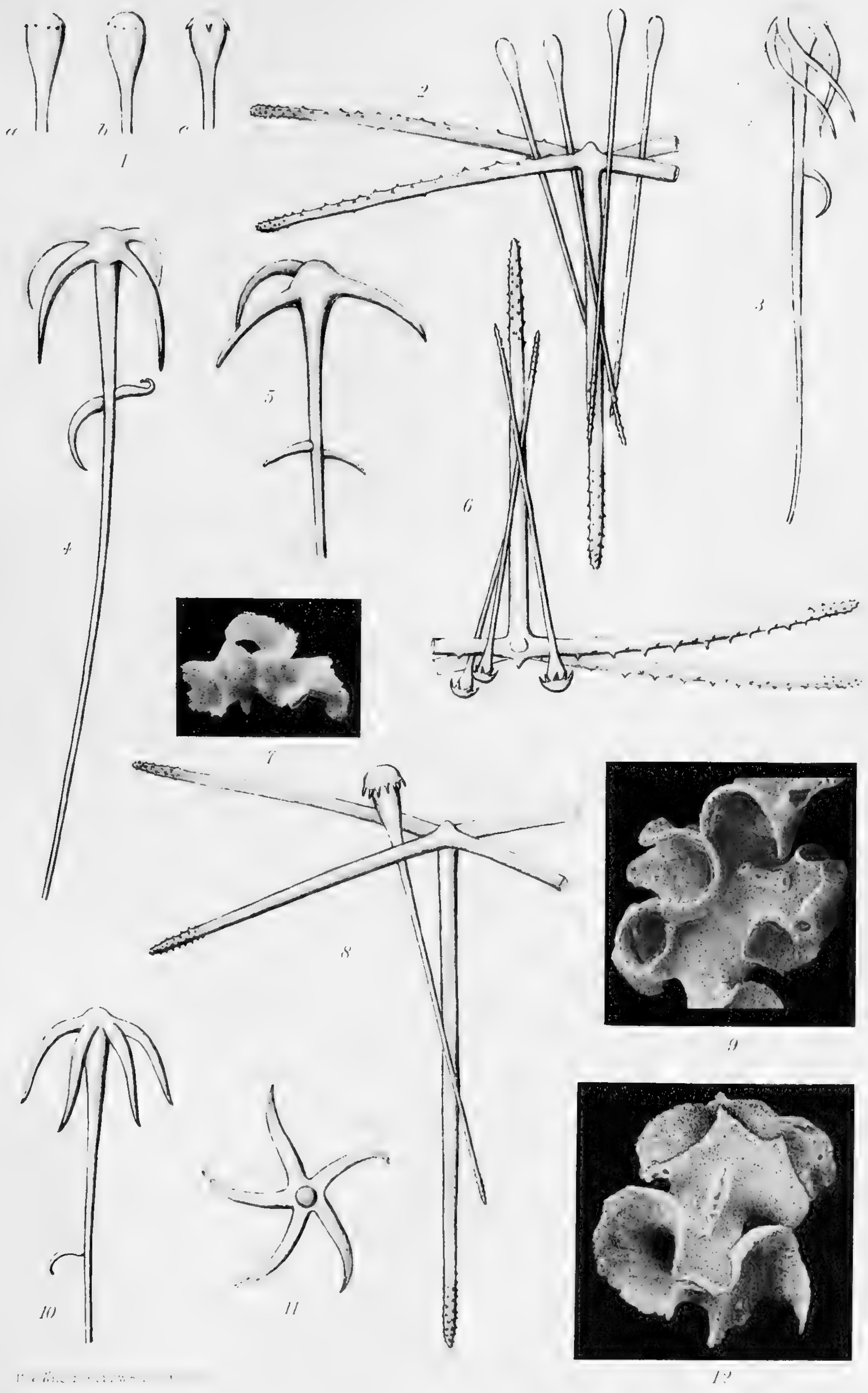
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Plate 8.

PLATE 8.

Fig. 1. *Eurete erectum tubuliferum.* From a photograph; sponge viewed from side; ½.
" 2. " " " Gastral hexact with scopula; x 250.
" 3. " " " Dermal pinulus with scopula; x 250.
" 4. *Eurete erectum gracile.* Onychaster; x 450.
" 5. " " " Dermal pinulus; x 250.
" 6. *Eurete erectum tubuliferum.* Gastral hexact; x 250.
" 7. *Eurete erectum mucronatum.* Oxyhexaster; x 450.
" 8. *Eurete erectum gracile.* Gastral hexact; x 250.
" 9. " " " Characteristic dermal scopula; x 450.

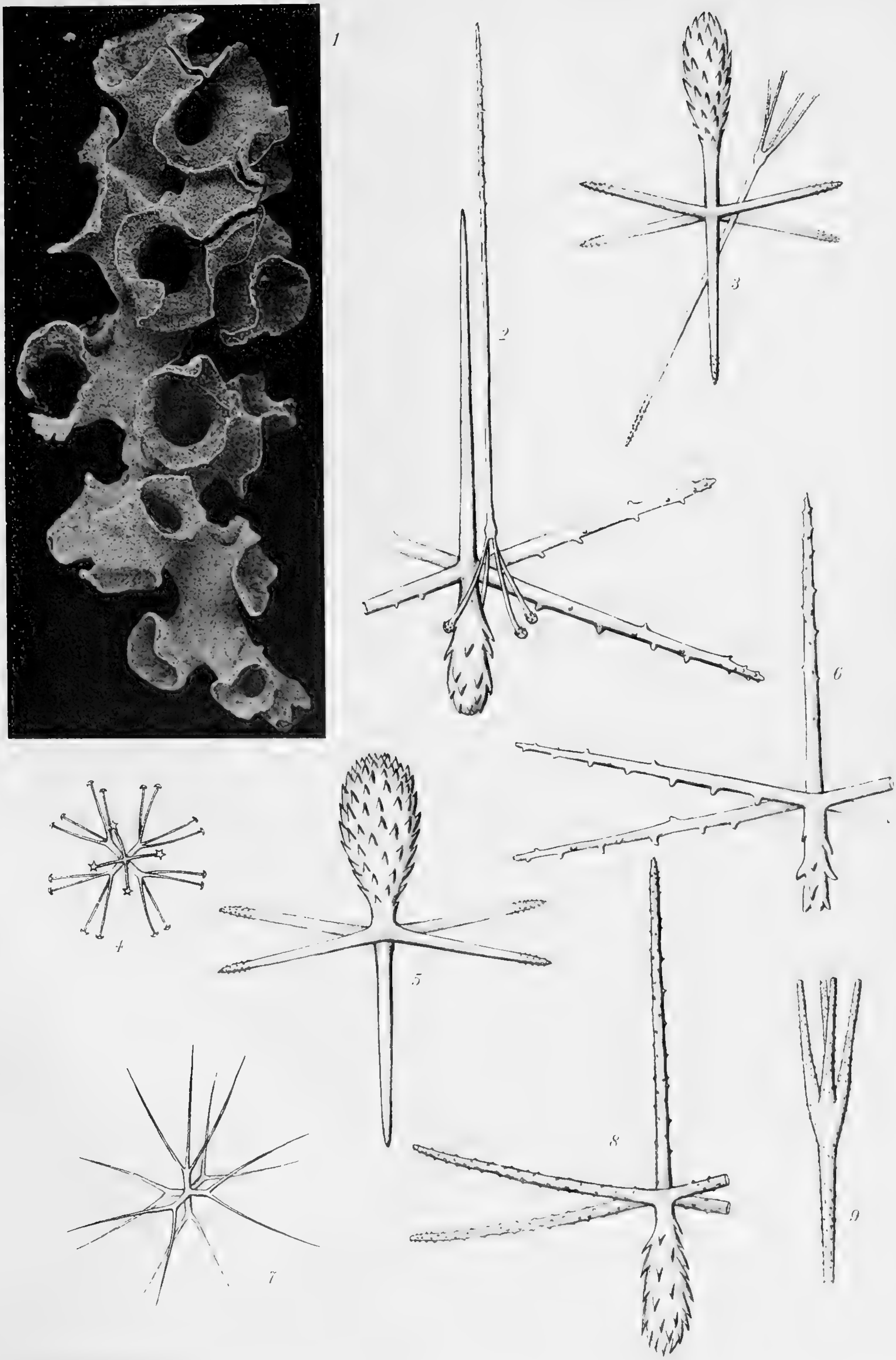
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PLATE 9.

Plate 9.

Fig. 1. *Eurete erectum gracile.* Gastral scopula; x 450.
" 2. *Sclerothamnopsis compressa.* From a photograph; $\frac{1}{1}$.
" 3. *Eurete erectum gracile.* Gastral scopula; x 450.
" 4. *Sclerothamnopsis compressa.* From a photograph; two of the smallest branches shown; x 2.
" 5. *Eurete erectum gracile.* From a photograph; $\frac{1}{1}$.
" 6. *Sclerothamnopsis compressa.* Pinulus; x 170.
" 7. " " Oxyhexaster; x 250.
" 8. " " Upper end of scopula; x 250.
" 9. *Regadrella, sp.* Skeletal framework; from a photograph; $\frac{1}{10}$.
" 10. *Sclerothamnopsis compressa.* Spinose hexact; x 170.
" 11. " " Skeletal reticulum; from a transverse section. Upper margin of figure represents surface of sponge; x 70.

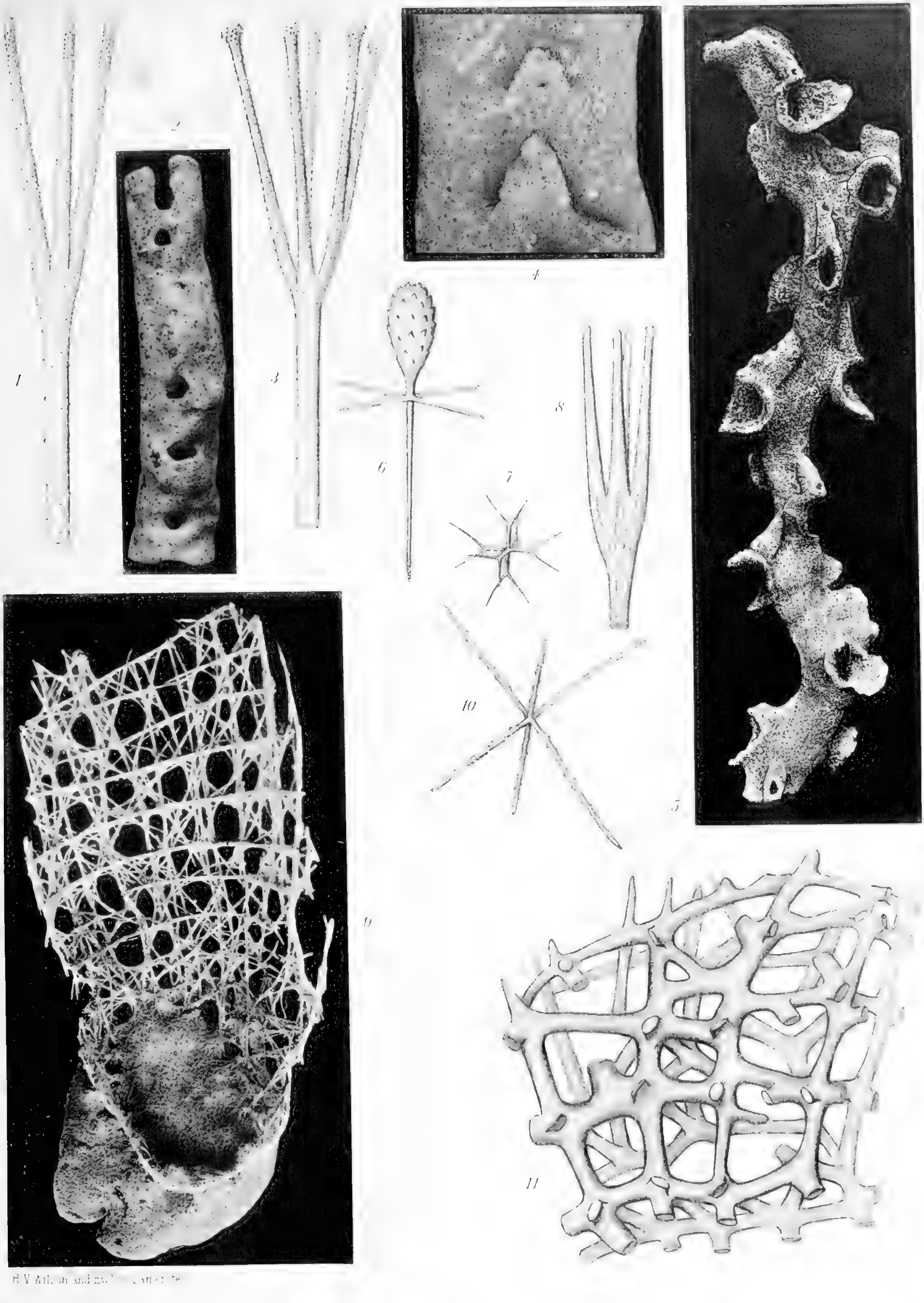

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Plate **10**.

Plate 10.

Fig. 1. *Sclerothamnopsis compressa.* From a photograph; $\frac{1}{1}$.

" 2. *Bathyxiphus, sp.* From a photograph. A small piece has been taken out, and the two parts fastened together with a pin; $\frac{1}{1}$.

" 3. *Sclerothamnopsis compressa.* From a photograph; $\frac{1}{1}$.

" 4. *Hexactinella labyrinthica.* Scopula; upper and lower ends; x 600.

" 5. *Chonelasma calyx* F. E. Sch. (sp.?). From a photograph. Sponge wall cut away so as to show septum; $\frac{1}{1}$.

" 6. *Hexactinella labyrinthica.* From a photograph; $\frac{1}{1}$.

" 7. " " Group of slender, spinose hexacts and pentacts, partially fused; x 300.

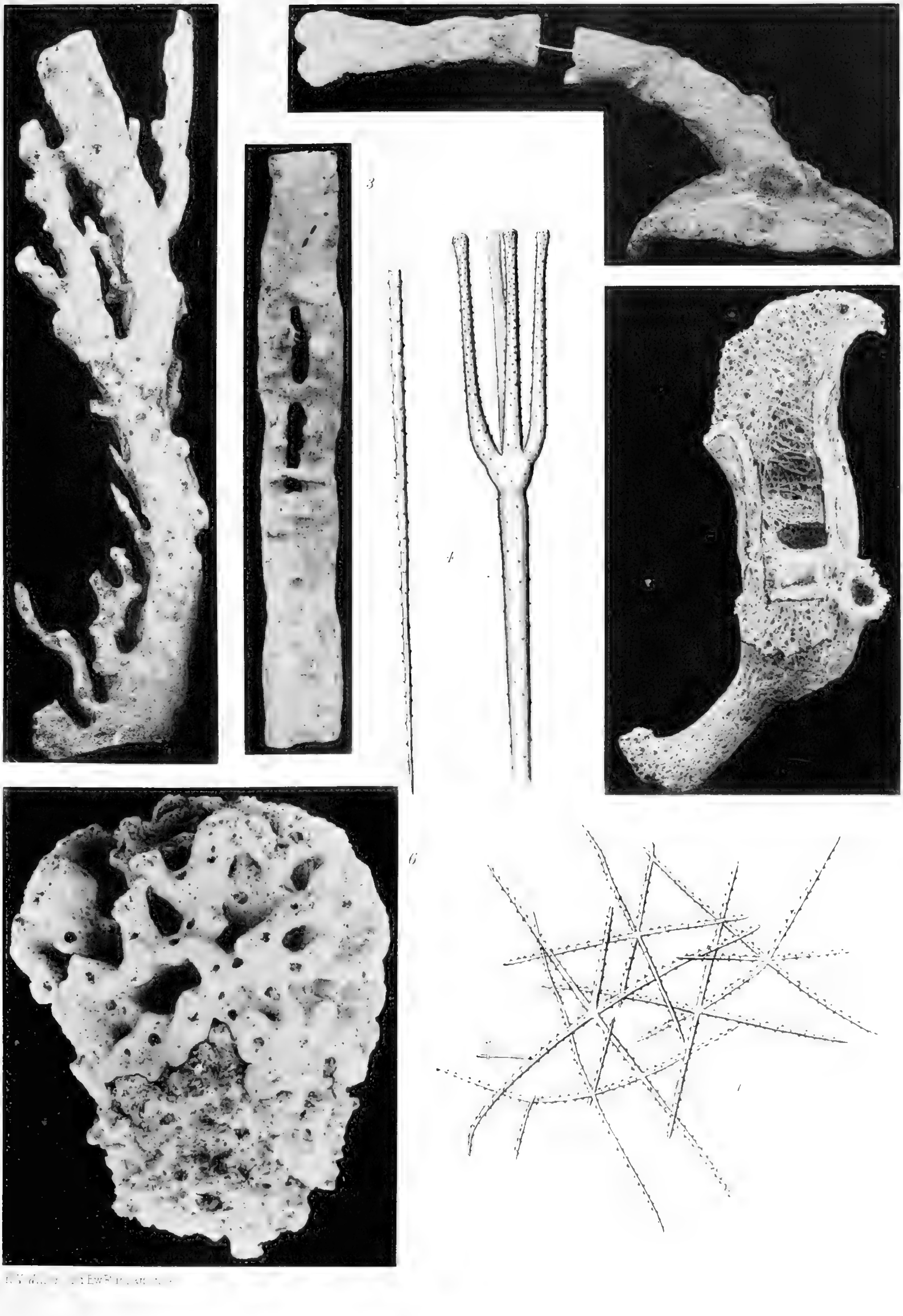
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PLATE 11.

Plate 11.

Fig. 1. *Hexactinella labyrinthica.* Lateral surface of skeletal plate. Vertical beams in figure are radial to sponge surface; macerated preparation; x 70.

" 2. " " Small scopula; x 600.

" 3. " " Discohexaster; x 600.

" 4. " " Dermal oxydiact; middle region and the two ends; x 600.

" 5. " " Dermal pentact (*a*), and aberrant proximal rays of two other pentacts (*b*, *c*); x 170.

" 6. " " Dermal membrane, showing pores and supporting pentact rays; x 100.

" 7. " " Section, vertical to surface. Just beneath dermal membrane are a large, and two small, afferent canals. Shaded tissue densely filled with flagellated chambers and small canals; x 70.

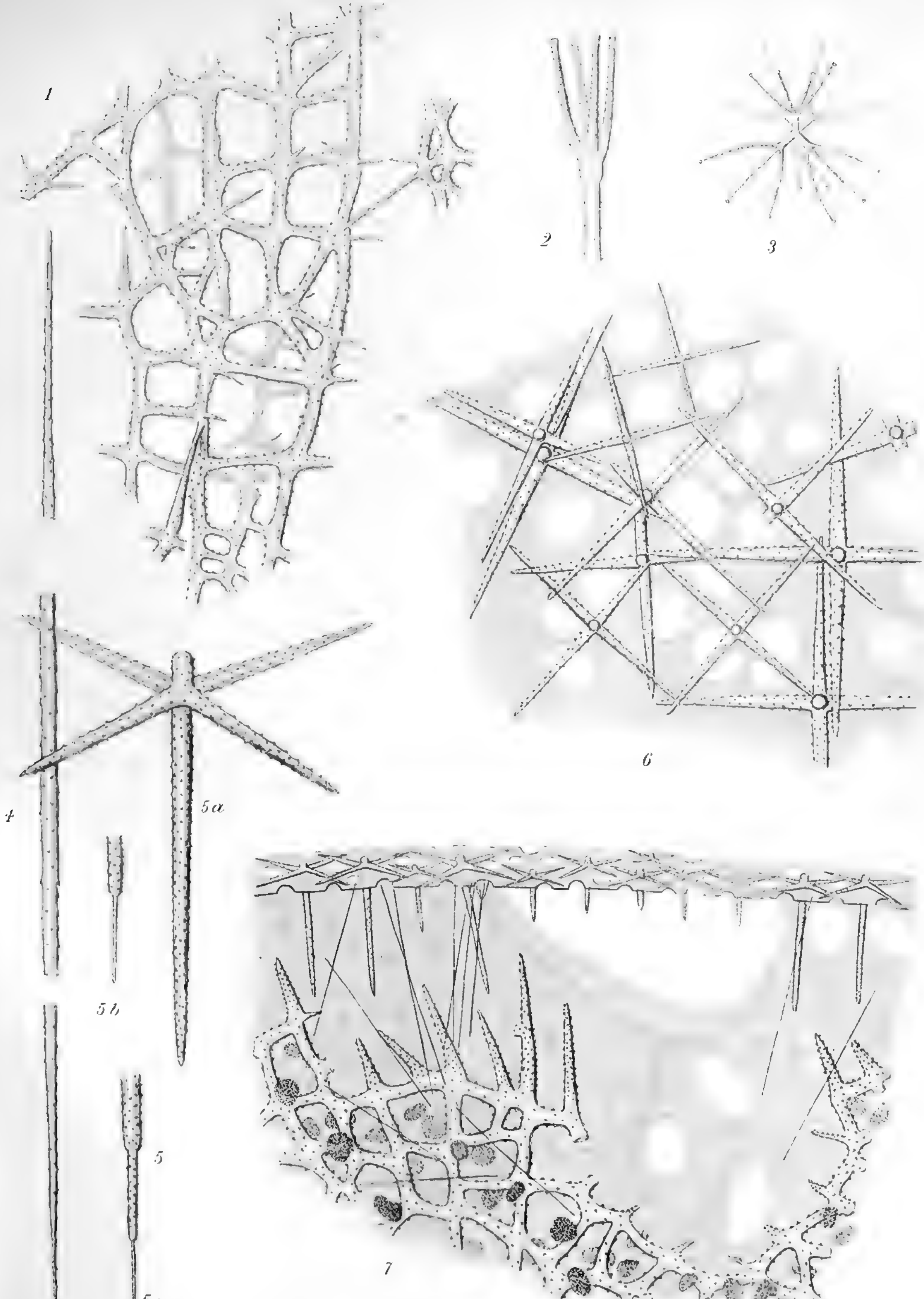

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PLATE **12**.

Plate 12.

Fig.	1.	*Thenea echinata.*	Upper surface; from a photograph; $\frac{1}{1}$.
"	2.	" "	From a radial section; upper surface of sponge and adjoining parenchyma; x 20.
"	3.	" "	Spirasters; x 600.
"	4.	" "	Protriaene; x 30.
"	5.	" "	Dichotriaene, modified toward protriaene; x 30.
"	6.	" "	Spicule from root; clavate at one end; x 100.
"	7.	" "	Cladome of dichotriaene; x 30.
"	8.	" "	Somal anatriaene; x 100.
"	9.	" "	From a photograph; from the side; $\frac{1}{1}$.
"	10.	*Thenea lamelliformis.*	Anatriaene, somal; x 150.
"	11.	" "	Anatriaene, radical; x 150.
"	12.	" "	Anatriaene, somal; x 40.
"	13.	" "	Upper surface; from a photograph; $\frac{1}{1}$.

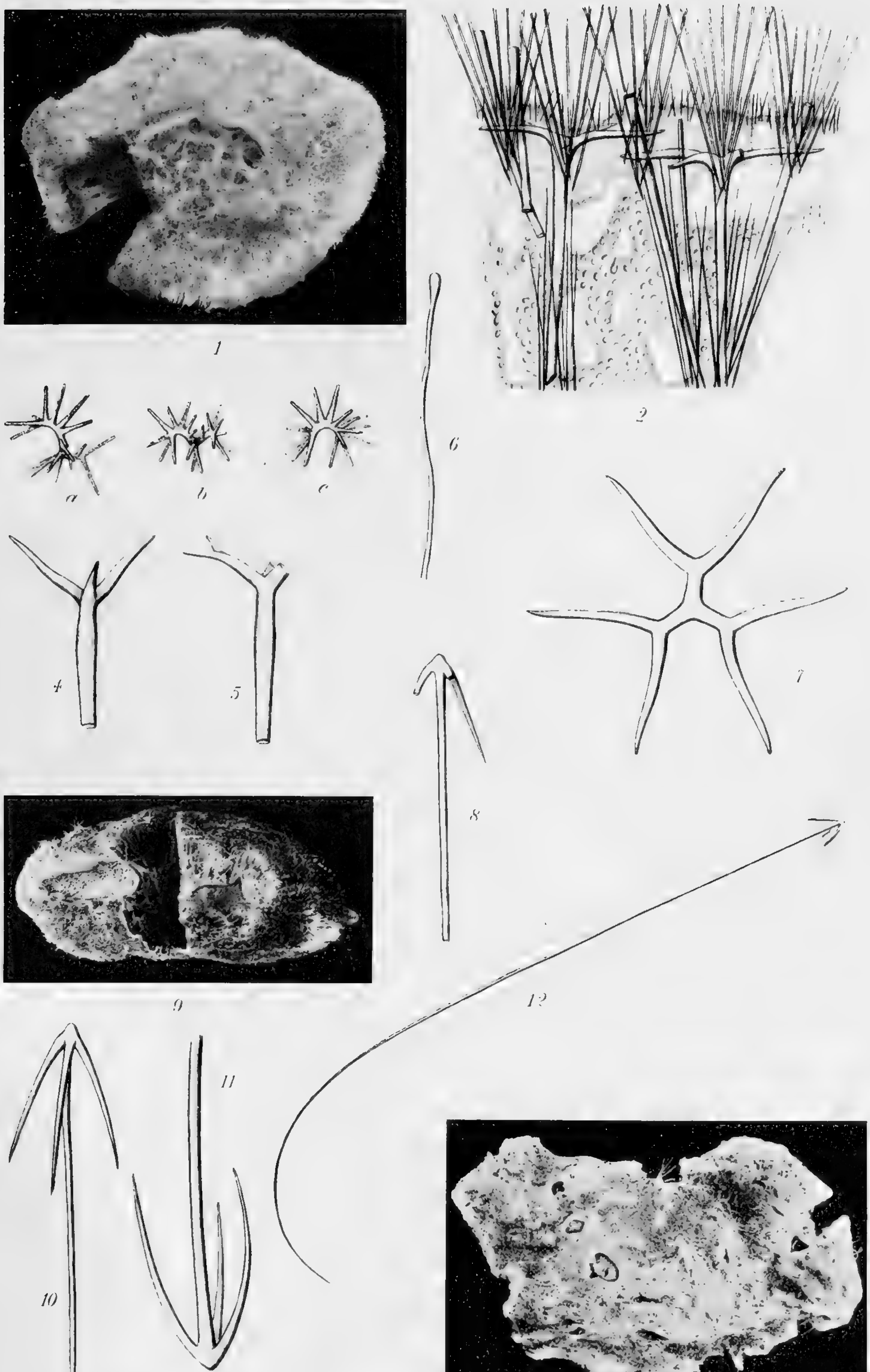

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Plate 13.

Plate 13.

Fig. 1. *Thenea lamelliformis.* Spirasters; x 600.
" 2. *Thenea fenestrata* O. Schm. From a photograph ; from above; $\frac{1}{1}$.
" 3. " " " Spirasters; x 600.
" 4. " " " Protriaene; x 100.
" 5. *Thenea pyriformis.* From a photograph; from the side; $\frac{1}{1}$.
" 6. *Thenea fenestrata* O. Schm. Protriaene; x 100.
" 7. " " " Dichotriaene, modified toward protriaene; x 100.
" 8. *Thenea pyriformis.* From a photograph; from above; $\frac{1}{1}$.
" 9. *Thenea fenestrata* O. Schm. From a photograph; from the side; $\frac{1}{1}$.
" 10. *Thenea pyriformis.* Parenchymal microscleres; x 600.
" 11. " " Microscleres of dermal membrane; x 600.
" 12. *Poecillastra tricornis.* Annulated microxea; x 150.
" 13. " " Triaene with reduced rhabdome; from the side; x 30.
" 14. " " Microxea, nearly smooth; x 400.

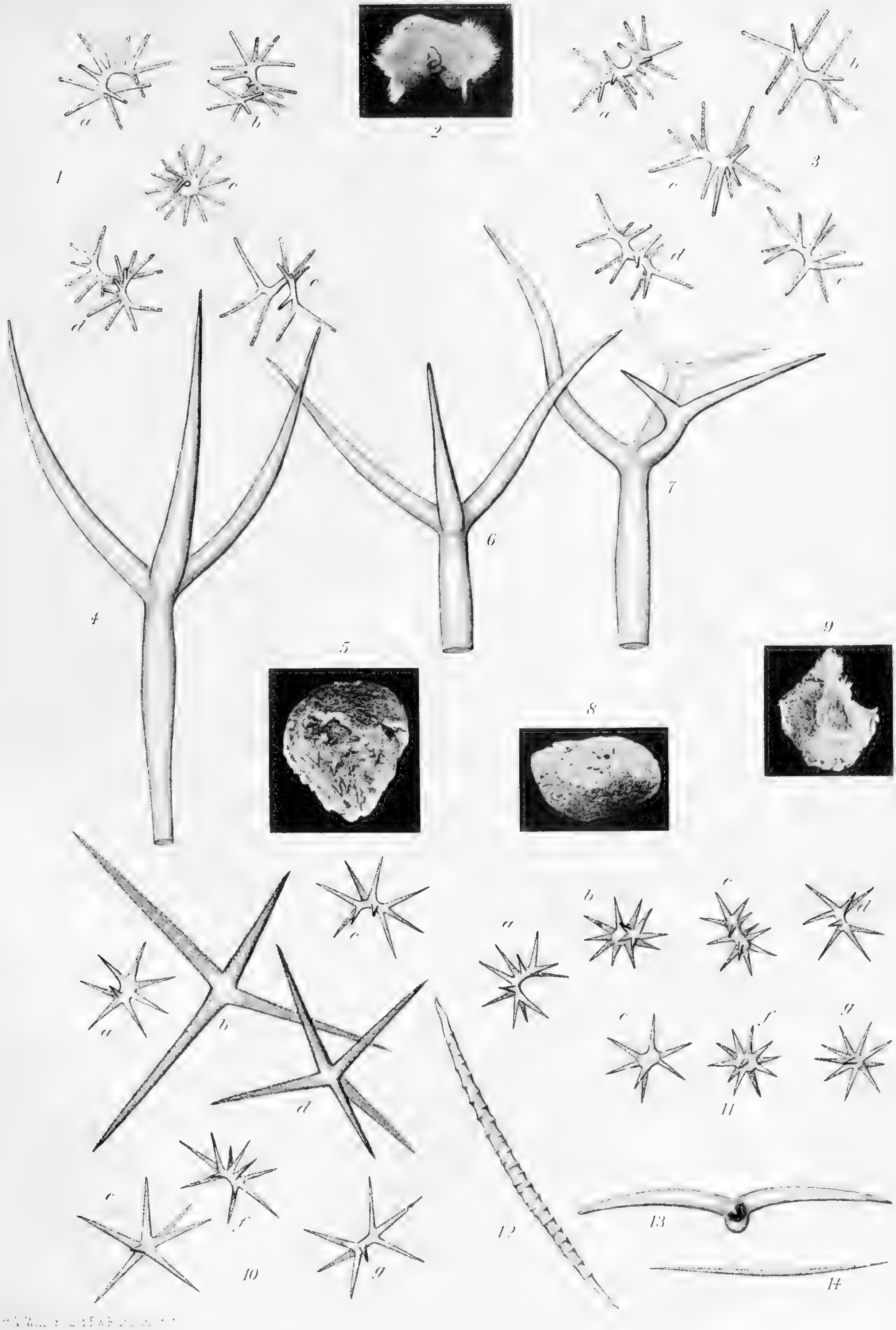


PLATE **14**.

Plate 14.

Fig. 1. *Poecillastra tricornis.* From a section tangential to surface, showing flagellated chambers with Sollas's membrane; *c. w.*, canal wall; x 250.

" 2. " " Streptasters; *a*, spiraster from dermal membrane; *c*, parenchymal metaster; *b*, *d*, parenchymal spirasters; x 600.

" 3. " " From a radial, vertical section, showing oscular surface, with an oscular depression, through the aperture at the bottom of which a shell of a Foraminifera is partially protruded. Below oscular membrane and aperture an incomplete septum extends across the canal; x 30.

" 4. " " From a radial, vertical section, showing pore surface. Pore membrane, forming bottom of a very shallow concavity, is produced into a plug-like process. Axis of this is marked by dense streak of spirasters, representing the closed pore. Side wall of canal, into which pore opens, is shown in perspective and exhibits apertures leading into branch canals. Canal wall bears some incomplete septa. Lowest and thickest septum is perforated by a small aperture, in immediate neighborhood of which is a collection of débris, largely shells of Foraminifera; x 30.

" 5. " " Pore surface. One pore area with nearly closed pore shown. Surface preparation; x 30.

" 6. " " Oscular surface. Three oscular membranes, one with open aperture, shown. Surface preparation; x 30.

" 7. " " From a radial, vertical section, showing oscular surface. A single oscular depression, floor of which constitutes the oscular membrane, is shown. Osculum itself closed. Canal to which osculum belongs exhibits on its lateral wall apertures of branches, and is crossed by perforated septa; x 30.

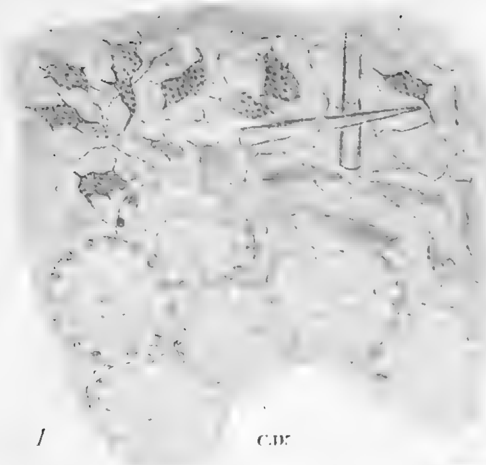
" 8. " " Oscular surface; from a photograph; 1/1.

" 9. *Poecillastra cribraria.* Cladome of triaene, from above; two rays branched; x 70.

" 10. " " Characteristic triaene, from the side; x 70.

" 11. " " Microxea; x 250.

" 12. " " Streptasters: *a*, spiraster from dermal membrane; *b*, plesiaster from parenchyma; *c*, *d*, plesiaster-metasters from parenchyma; x 600.



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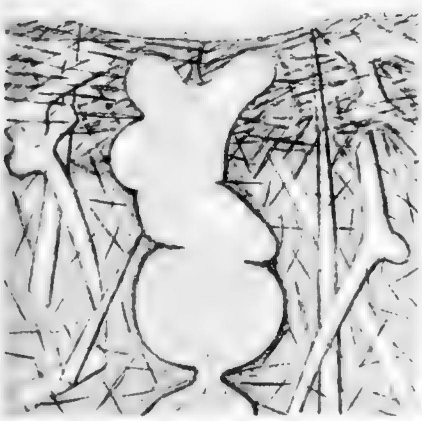

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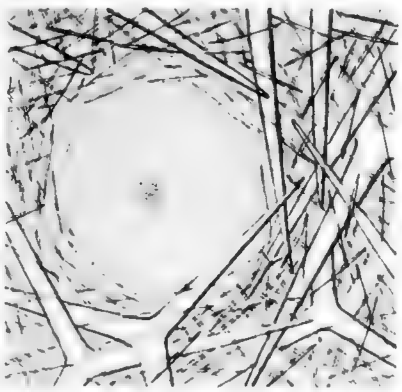

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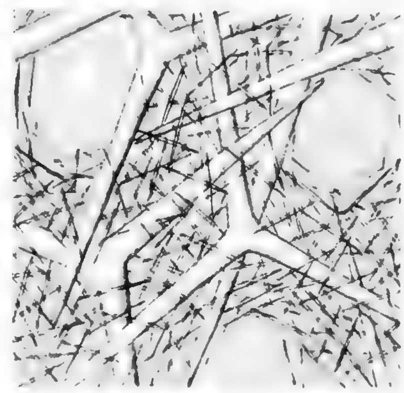

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PLATE 15.

Plate 15.

Fig. 1. *Poecillastra cribraria.* From a radial vertical section, showing oscular surface. Parenchyma with abundant conspicuous granular cells; x 100.

" 2. " " From a section. Posterior wall of flagellated chamber showing several chamber-pores. Boundary membrane of chamber is a thin, finely granular membrane showing no cell-boundaries. On it rest the cell-bodies (wide apart) of the collar cells, appearing as dense angular masses, each enclosing a nucleus; x 1000.

" 3. " " Oscular surface; surface preparation; x 30.

" 4. " " Pore surface; " " x 30.

" 5. *Penares foliaformis.* From a section. A flagellated chamber opens to the right into its efferent canaliculus; afferent canaliculus abutting against boundary membrane of chamber, to left; Sollas's membrane in perspective. Two other flagellated chambers are cut. In right lower corner, a part of an ovum (*ov.*) with part of its nucleus is included; x 1000.

" 6. " " From a section vertical to surface of sponge, showing choanosome with a number of small efferent canals cut lengthwise; some canals leading in the section to the flagellated chambers from which they start. The small efferent canals unite to form the two larger canals of the figure. These unite in the next section. Other canals, some cut transversely, appear; some of them, afferent canals; *c.w.*, canal wall; x 70.

" 7. " " Surface; from a photograph; ½.

" 8. " " Microrhabds; x 250.

" 9. " " Vertical section showing ectosome and adjoining choanosome. Two radial pore canals open, each into a subdermal chamber; x 30.

" 10. " " Oxyasters; x 600.

" 11. " " Surface, showing arrangement of pores and cladomes of the triaenes. Microrhabds with which dermal membrane is densely filled, and which extend over the cladomes as well as throughout the pore areas, are omitted. Surface preparation; x 30.

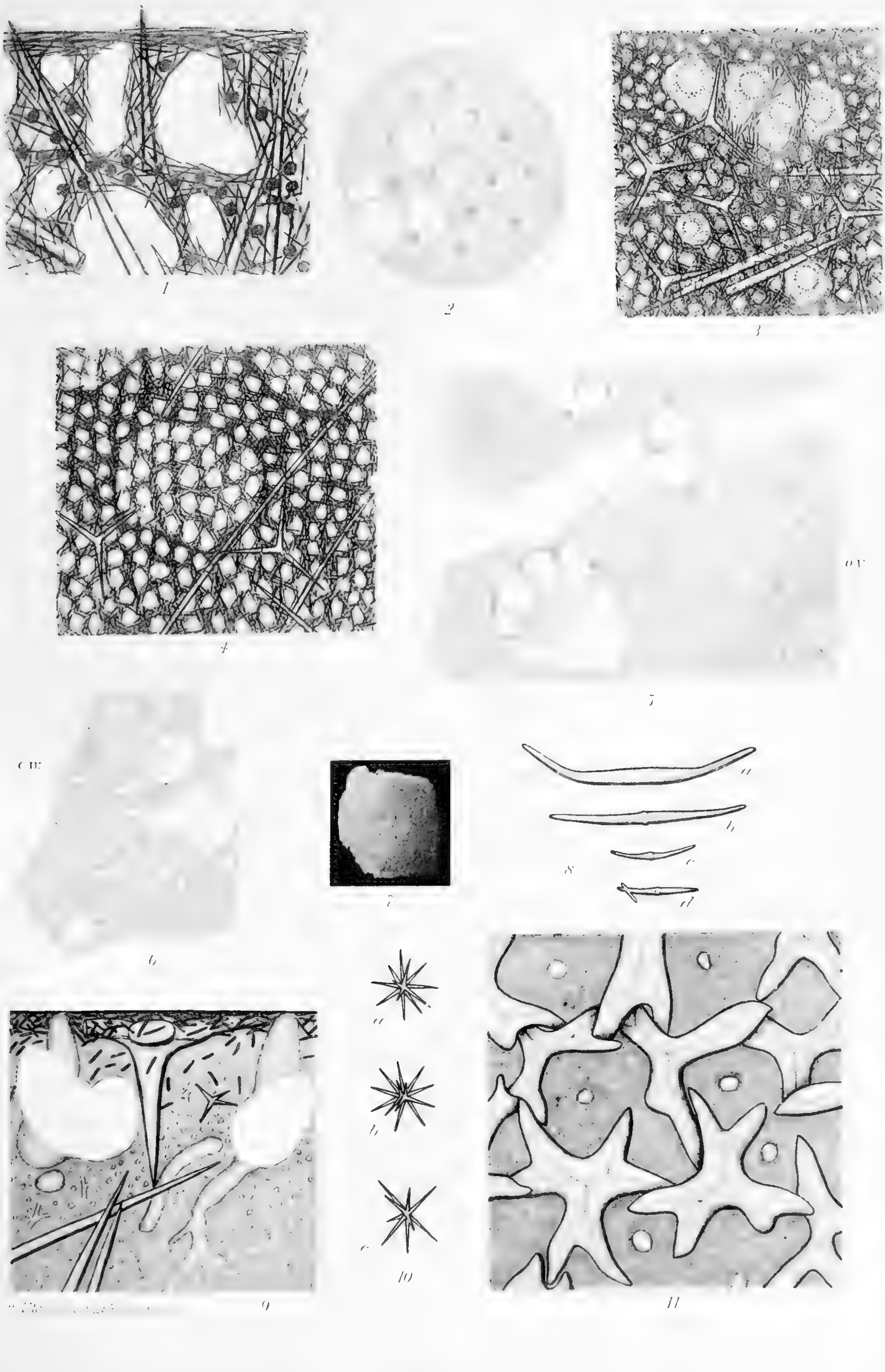
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Plate 16.

PLATE 16.

Fig. 1. *Poecillastra cribraria.* From a section; *c. w.*, canal wall. A flagellated chamber occupies a thin trabecula. It opens, to the right, by a wide aperture into efferent canal. Its boundary membrane, to the left, is perforated by a single chamber pore. Collar cells extend between boundary membrane and Sollas's membrane; the latter shown in section and perspective; x 1000.

" 2. *Polymastia maeandria.* From a photograph; from the side; $\frac{1}{1}$.

" 3. *Poecillastra cribraria.* From a photograph; oscular surface; $\frac{1}{1}$.

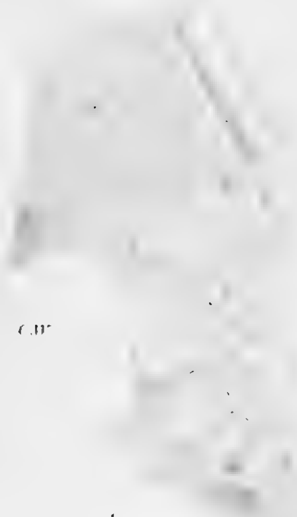
" 4. *Polymastia maeandria.* Transverse section through wall of oscular papilla; *c. w.*, wall of axial canal. Above are the surface brushes of small tylotes. Two longitudinal spicular bundles are cut; x 70.

" 5. " " Spicules; x 70.

" 6. " " Section vertical to surface of sponge and through a mammillary protuberance. Beneath superficial layer of small spicules lies layer of more or less tangentially arranged tylostyles. Five radial skeletal bundles appear. Main afferent canal in mammillary protuberance connects with a larger internal canal through a chone-like structure. Small subdermal spaces with pore canals are seen, especially in region of mammillary protuberance; x 10.

" 7. *Pachychalina acapulcensis.* Longitudinal section, vertical to surface, of macerated sponge. Surface of sponge to the right. A longitudinal skeletal bundle, *l. b.*, appears; skeletal network in general irregular; *s. v.*, surface villi; x 20.

" 8. " " From a photograph; from the side; $\frac{1}{2}$.



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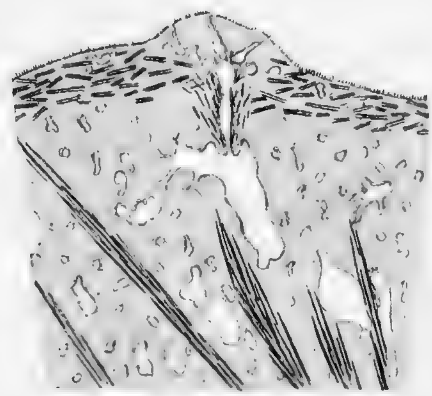

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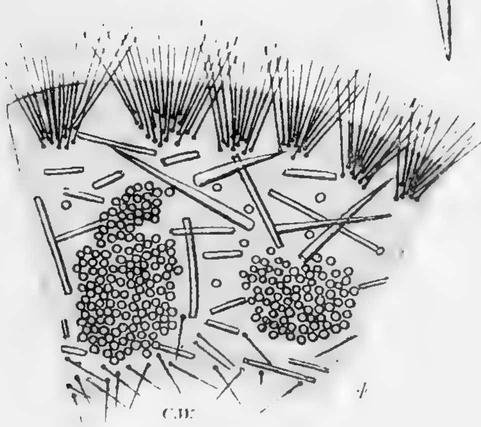

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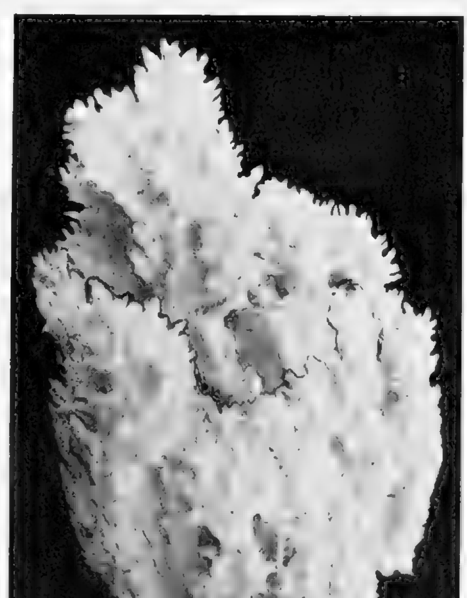

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Plate 17.

Plate 17.

Fig. 1. *Pachychalina acapulcensis.* Dermal membrane. Pores and dermal reticulum with villi. Surface preparation; x 70.

" 2. " " Horizontal section, vertical to surface, of macerated sponge. Surface of sponge above. A longitudinal skeletal bundle, *l. b.*, is cut transversely. Skeletal network comparatively regular; *s. v.*, surface villi; x 20.

" 3. " " Large radial skeletal fibre; x 300.

" 4. " " Small connective; x 300.

" 5. " " One of the finest fibres, subdividing a skeletal mesh; x 300.

" 6. *Petrosia variabilis crassa.* Oxeas, with spongin; x 100.

" 7. *Petrosia similis densissima.* From a photograph; ½.

" 8. *Oceanapia bacillifera.* Surface of fistula; x 100.

" 9. *Petrosia variabilis crassa.* From a photograph; ½.

" 10. *Petrosia similis densissima.* Oxea and flagellated chambers, one of which opens into efferent canal; x 250.

" 11. *Gellius perforatus.* End of skeletal oxea, with sigmata; x 450.

" 12. *Petrosia variabilis crassa.* From a photograph; ½.

" 13. *Pachychalina acapulcensis.* Longitudinal section through macerated conulus. An axial bundle of spiculo-fibre gives off, and ultimately divides into, radial fibres; *s. v.*, surface villi; x 20.

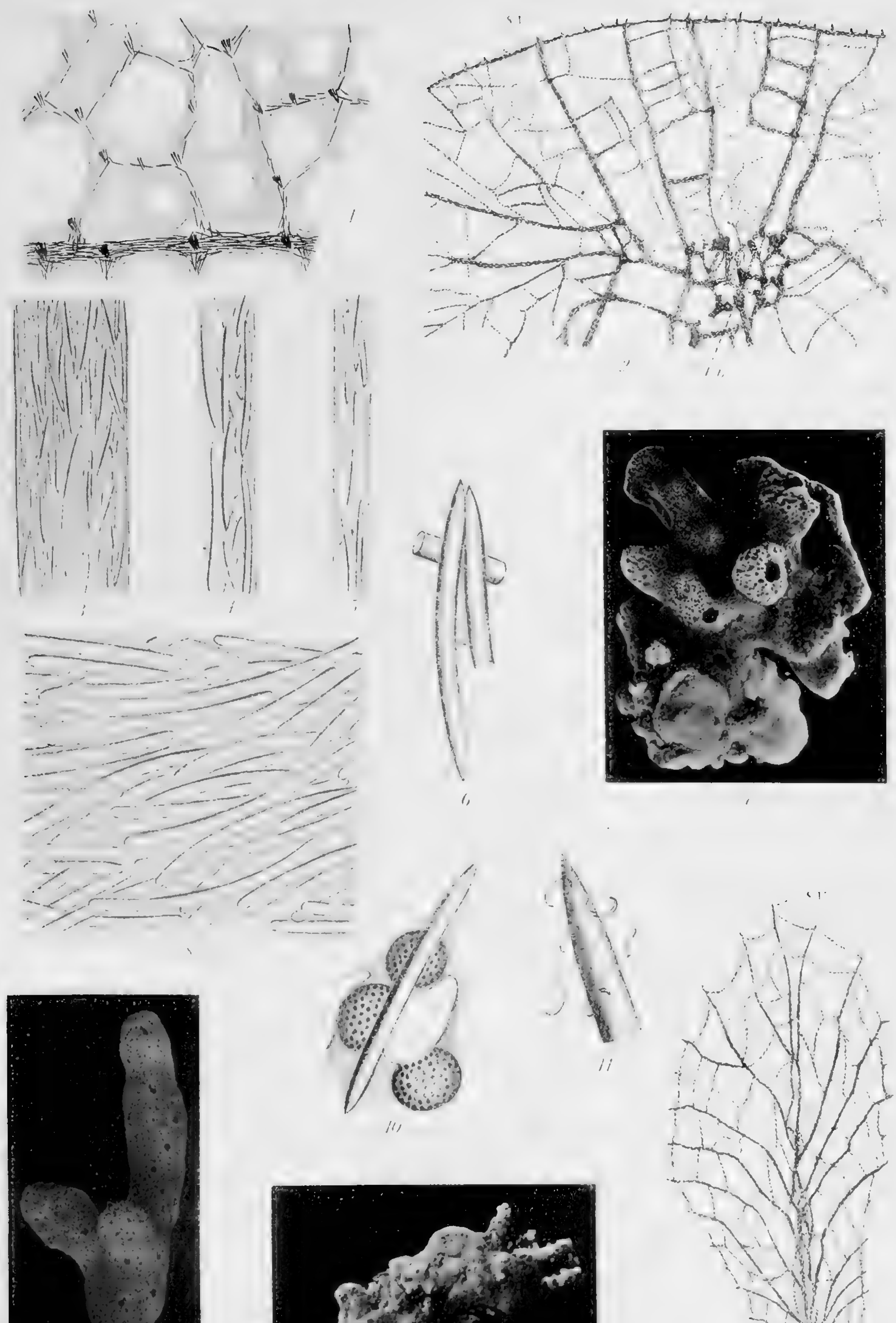


Plate **18**.

PLATE 18.

Fig. 1. *Gellius perforatus.* Upper surface; from a photograph; $\frac{1}{1}$.

" 2. *Oceanapia bacillifera.* Fistula; from a photograph; $\frac{1}{1}$.

" 3. *Hymeraphia, sp.* incrusting *Oceanapia bacillifera.* Spicules; x 450.

" 4. *Oceanapia bacillifera.* Tangential section through wall of fistula, showing arrangement of skeletal spicules and spongin. Meshes in the skeletal framework, which in the figure are represented as vacant, are filled with parenchyma; x 70.

" 5. *Tylodesma alba.* Megascleres; x 70.

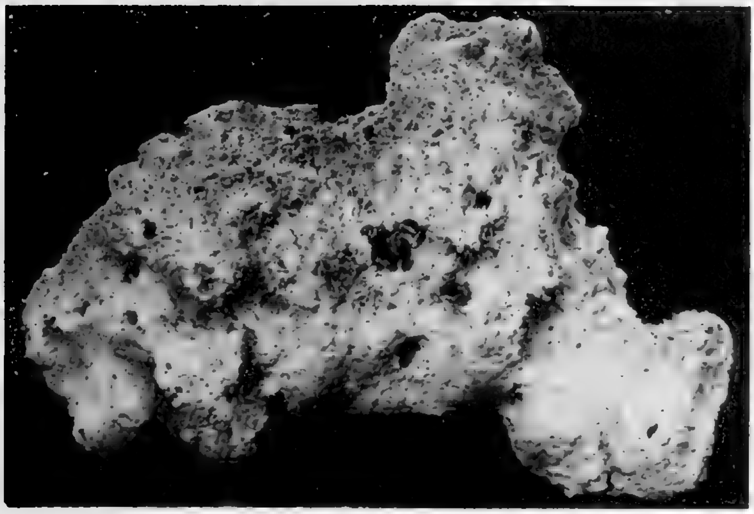
" 6. " " Sigmata; x 450.

" 7. " " From a photograph. Sponge viewed obliquely from the side, so that upper surface is seen; $\frac{1}{1}$.

" 8. *Tylodesma vestibularis.* Megascleres; x 70.

" 9. " " Sigmata; x 450.

" 10. *Phakellia lamelligera.* Outer surface of skeletal framework. Piece has been macerated in potash. From a photograph; x 5.



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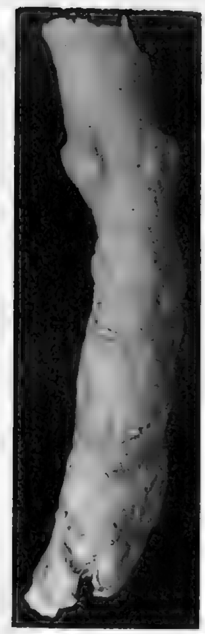

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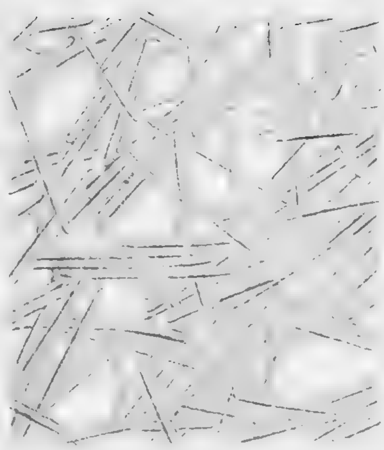

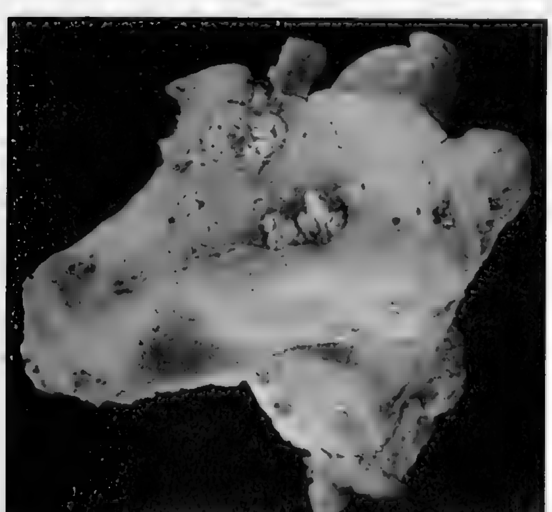

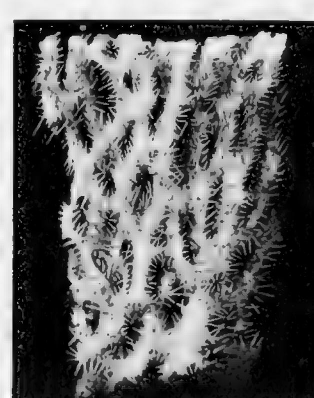

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PLATE 19.

Plate 19.

Fig. 1. *Tylodesma vestibularis.* From a photograph. Sponge viewed from the side; whitish conglomerate below. Vestibular spaces appear as darker areas. The one best brought out in the figure is well to the left, and has indented margins. The small darker area at extreme left of this space is an osculum; x $\frac{1}{1}$.

" 2. *Phakellia lamelligera.* Spicules; x 70.

" 3. " " From a photograph. Sponge seen obliquely from the side; x $\frac{7}{10}$.

" 4. *Auletta dendrophora.* Inner face of sponge wall, lining paragastric cavity. Apertures of radiating canals appear; *l. b.*, longitudinal skeletal bundles; x 100.

" 5. " " From a transverse section through a "person." Surface of sponge above. A radiating canal opens into a subdermal cavity, *s. c.* Part of the wall of the latter is seen in perspective. Wall of another cavity in lower left corner seen in perspective. On each side of the radiating canal, section strikes a radiating bundle of spicules (styles); x 100.

" 6. *Iophon indentatus.* Microscleres; *a*, anisochela in lateral view; *b*, bipocillus from concave side; *c*, bipocillus, apical view of larger end; *d*, bipocillus from convex side; *e*, bipocillus in lateral view; x 1000.

" 7. *Auletta dendrophora.* From a photograph; sponge seen somewhat obliquely from the side; x $\frac{1}{1}$.

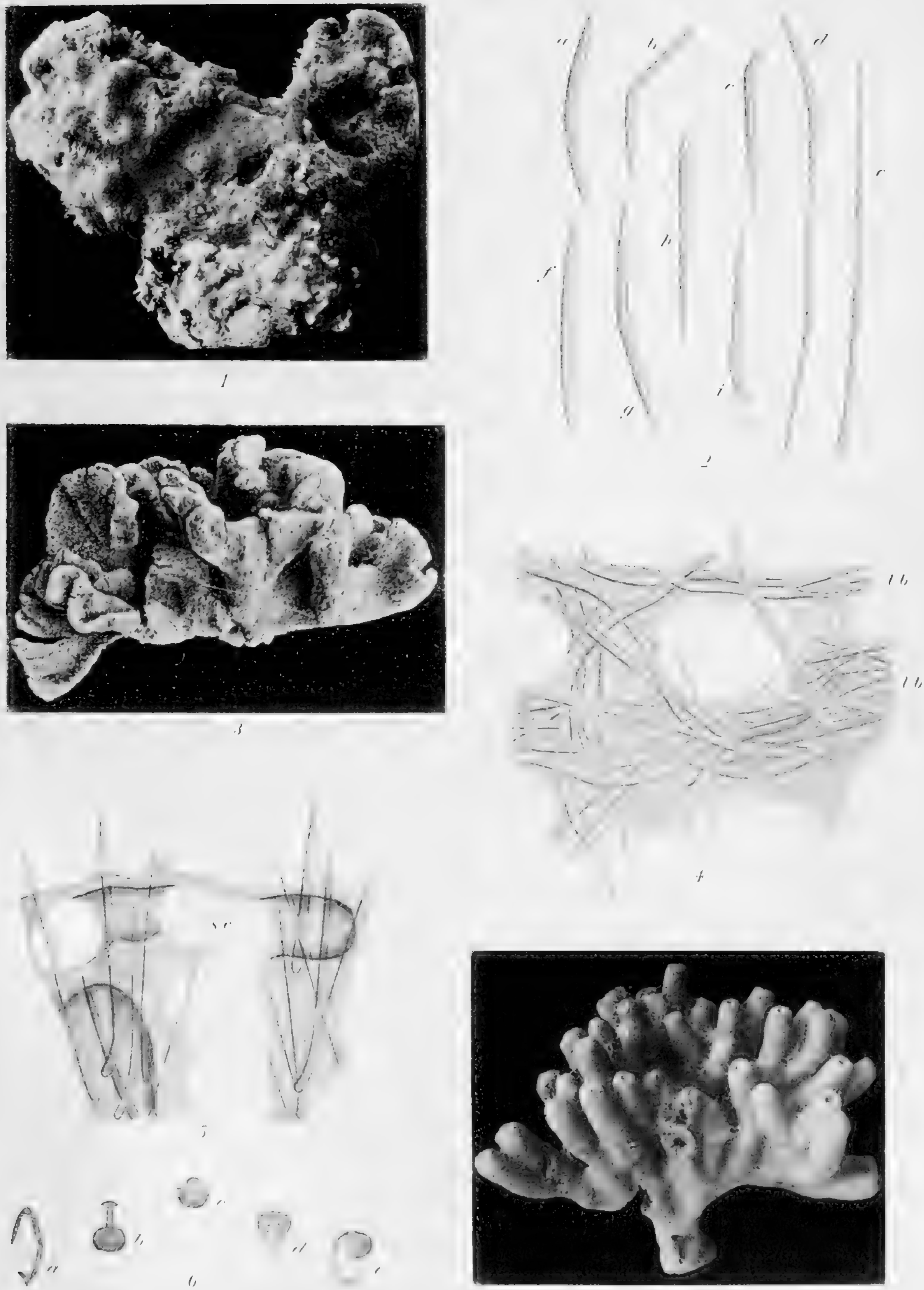

Plate 20.

Plate 20.

Fig. 1. *Iophon indentatus.* From a photograph; x $\frac{1}{1}$.

" 2. *Iophon chelifer ostia-magna.* Microscleres; *a*, bipocillus from concave side and smaller end; *b*, anisochela in lateral view; *c*, bipocillus in slightly oblique lateral view; *d*, bipocillus from concave side, larger plate in optical section; x 1000.

" 3. *Iophon lamella.* From a photograph. Oscula depressed and surrounded with collenchyma; x $\frac{1}{1}$.

" 4. *Iophon chelifer ostia-magna.* From a photograph. Margin of sponge, with large oscula, to the right; x $\frac{1}{1}$.

" 5. *Iophon indentatus.* Skeletal style; x 250.

" 6. " " Tylote; x 250.

" 7. *Iophon lamella.* Microscleres; *a*, bipocillus from convex side; *b*, anisochela in lateral view; *c*, bipocillus in lateral view; x 1000.

" 8. " " Skeletal style; x 250.

" 9. " " Tylote; x 250.

" 10. *Iophon chelifer ostia-magna.* Skeletal style; x 250.

" 11. " " " Tylote; x 250.

" 12. *Iophon lamella.* From a photograph; upper surface; x $\frac{1}{1}$.

" 13. " " From a photograph. Lower surface of the specimen shown in Fig. 12; x $\frac{1}{1}$.

" 14. *Iophon lamella indivisus.* From a photograph; under surface; x $\frac{1}{1}$.

" 15. " " " Microscleres; *a*, bipocillus from convex side; *b*, anisochela in ventral view; *c*, bipocillus from concave side; *d*, bipocillus in lateral view; *e*, bipocillus, apical view of larger end; *f*, bipocillus, apical view of smaller end; x 1000.

" 16. " " From a photograph. Upper surface of specimen shown in Fig. 14; x $\frac{1}{1}$.

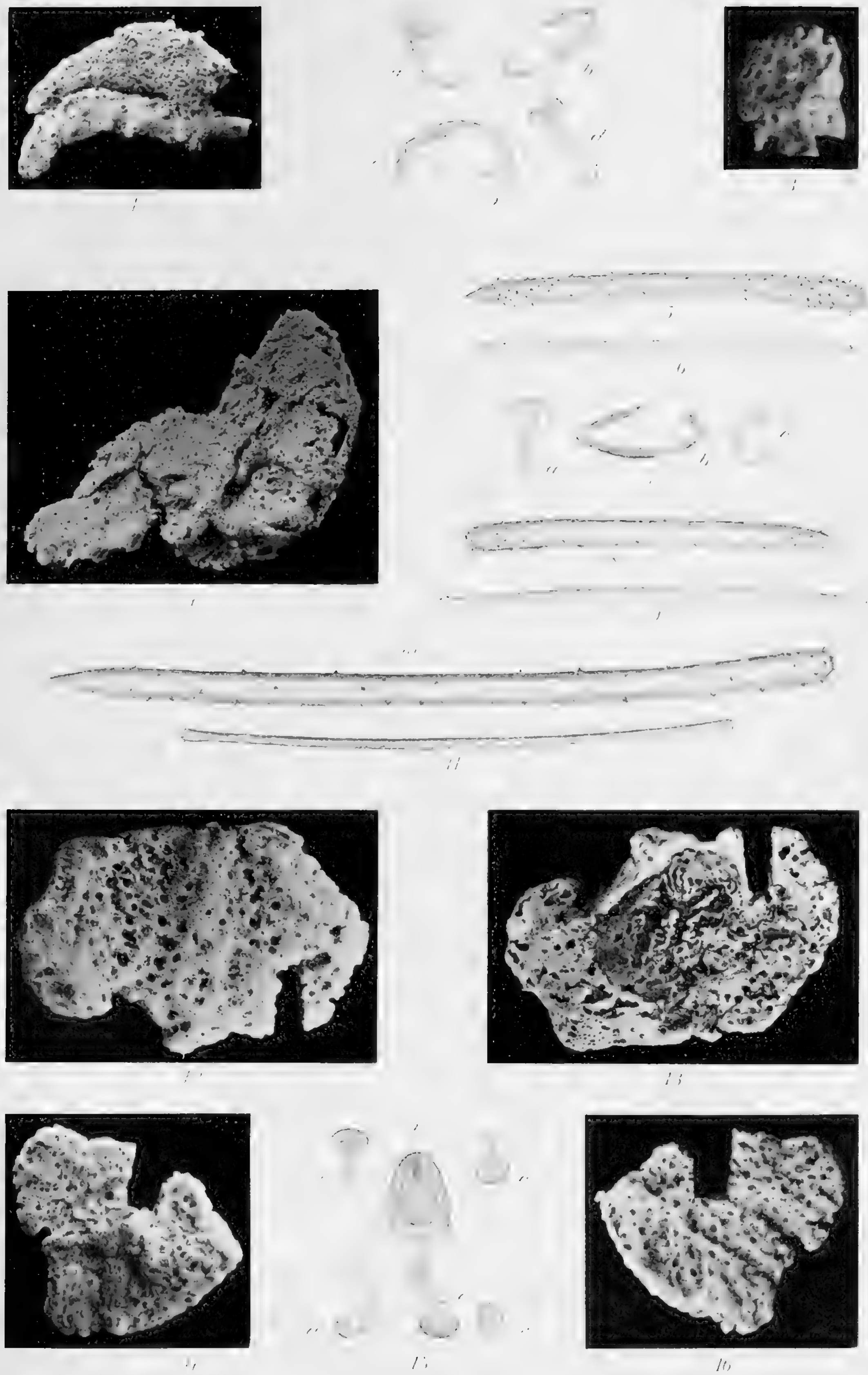

Plate **21**.

Plate 21.

Microphotographs of thick unstained preparations, showing skeletal arrangement.

Fig. 1. *Polymastia maeandria.* Dermal surface; x 50.

" 2. *Petrosia variabilis crassa.* " " x 20.

" 3. " " " Section vertical to surface, which is represented by upper margin of figure; x 15.

" 4. *Petrosia similis densissima.* Section vertical to surface, which is represented by upper margin of figure; x 15.

" 5. " " " Dermal surface; x 20.

" 6. *Gellius perforatus.* Dermal surface; x 25.

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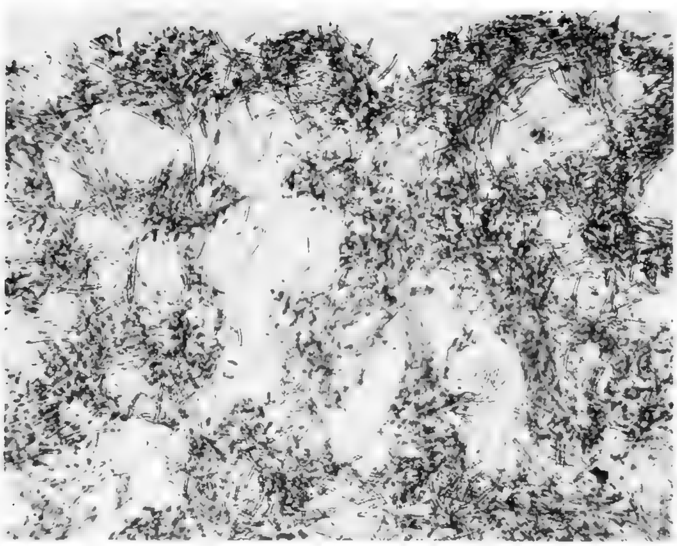

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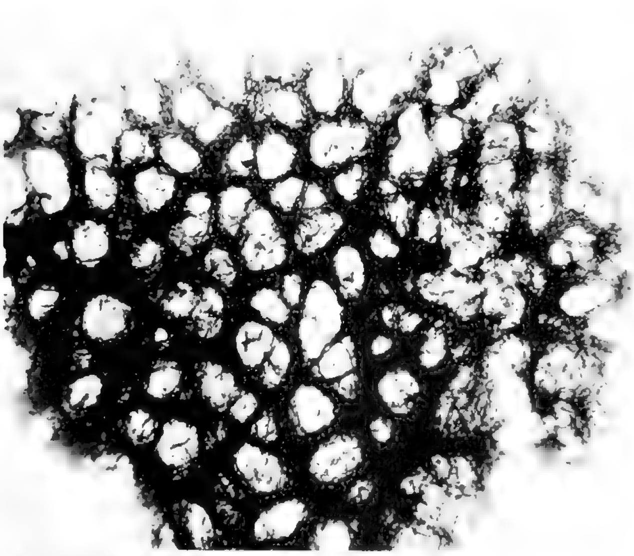

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PLATE 22.

Plate 22.

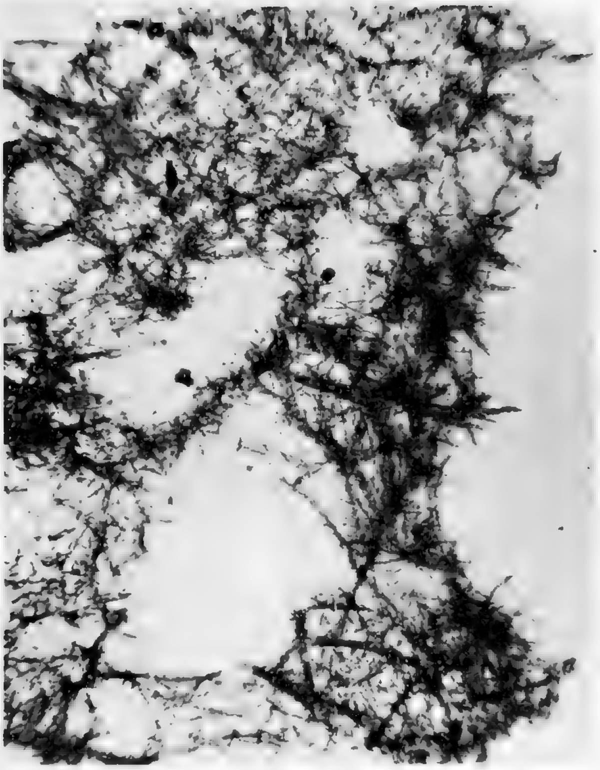
Microphotographs of thick unstained preparations showing skeletal arrangement.

Fig. 1. *Gellius perforatus.* Section vertical to surface, which is represented by right margin of figure; x 15.

" 2. *Tylodesma alba.* Section vertical to surface, which is represented by right margin of figure. Dermal surface in upper part of figure is roughened with projecting spicular tufts, elsewhere smooth; x 15.

" 3. " " Section vertical to surface, which is represented by right margin of figure. Surface is smooth, although it scarcely appears so, owing to the fact that it is partially seen in perspective; x 15.

" 4. *Tylodesma vestibularis.* Section vertical to surface, which is represented by right margin of figure. A vestibular space is cut across. The hexactinellid skeleton is conspicuous in the deeper part of the section; x 15.



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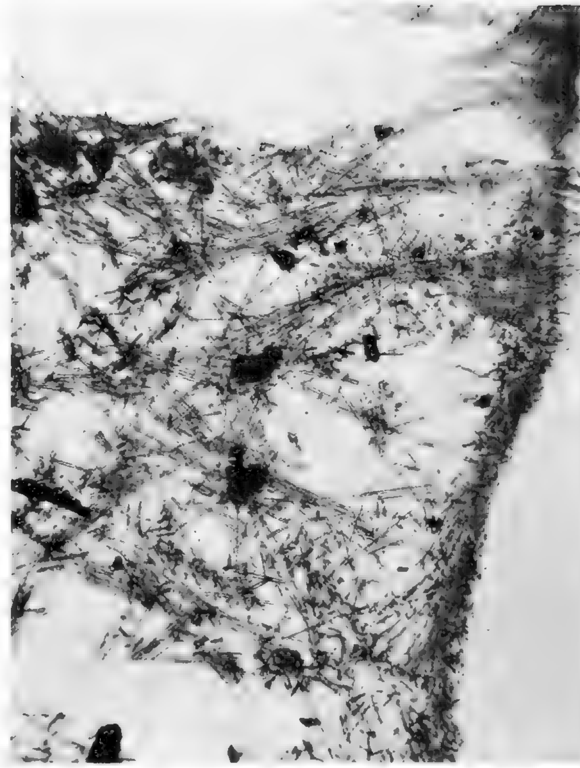

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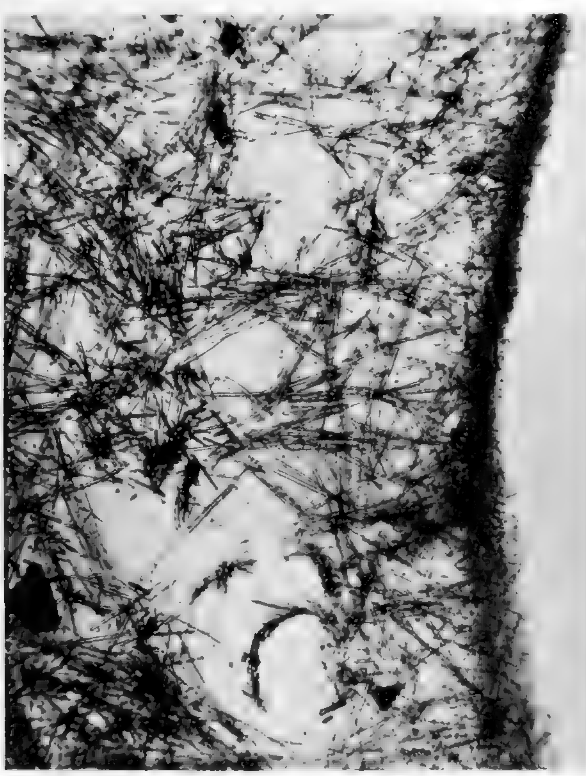

H. V. Wilson and Zehle, photogr. 3

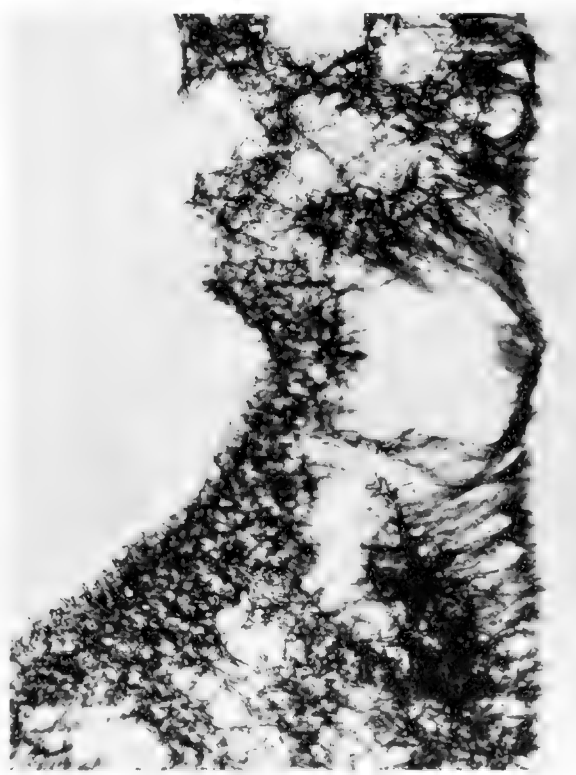

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Plate 23.

Plate 23.

Microphotographs of thick unstained preparations showing skeletal arrangement.

Fig. 1. *Tylodesma vestibularis.* Section vertical to surface of sponge, which is represented by right margin of figure. Hexactinellid skeleton appearing in deeper part of section; x 25.

" 2. " " Dermal membrane covering in a large vestibular cavity. Upper right margin represents edge of osculum; x 15.

" 3. " " Dermal membrane covering in, and adjoining, a medium-sized vestibular cavity; x 15.

" 4. *Iophon indentatus.* Section vertical to surface, which is represented by right margin of figure. Section includes large part of the *Gorgonia* axis (to the left); x 25.

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Plate 24.

Plate 24.

Microphotographs of thick unstained preparations showing skeletal arrangement.

Fig. 1. *Iophon chelifer ostia-magna.* From a section vertical to surface and radial to margin of sponge, and passing through a large marginal osculum and efferent canal (*cf.* Fig. 4, Pl. 20). Figure includes thickness of sponge lying between surface and canal. Right margin of figure represents surface of sponge; left margin, canal wall; x 15.

" 2. *Iophon lamella.* Surface; reticulate condition; x 15.

" 3. " " Section vertical to surface, and through entire thickness of lamellate body. Right and left margins of figure represent surfaces of body; x 15.

" 4. " " Idem; x 15.

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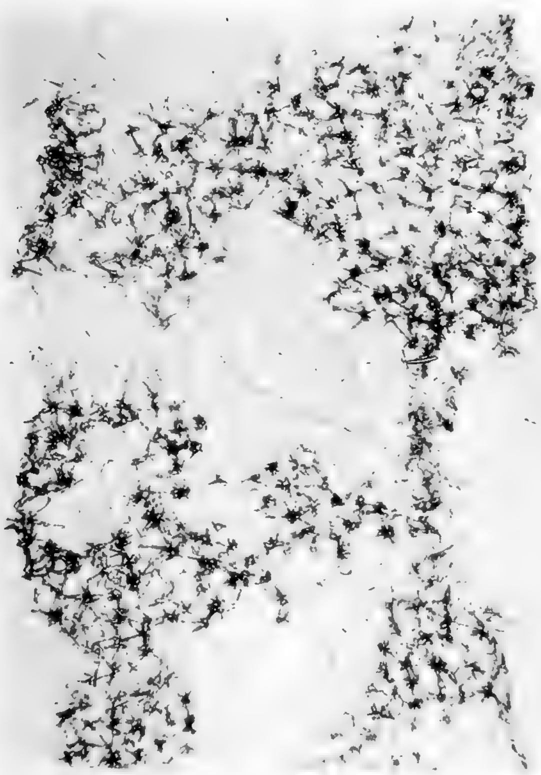

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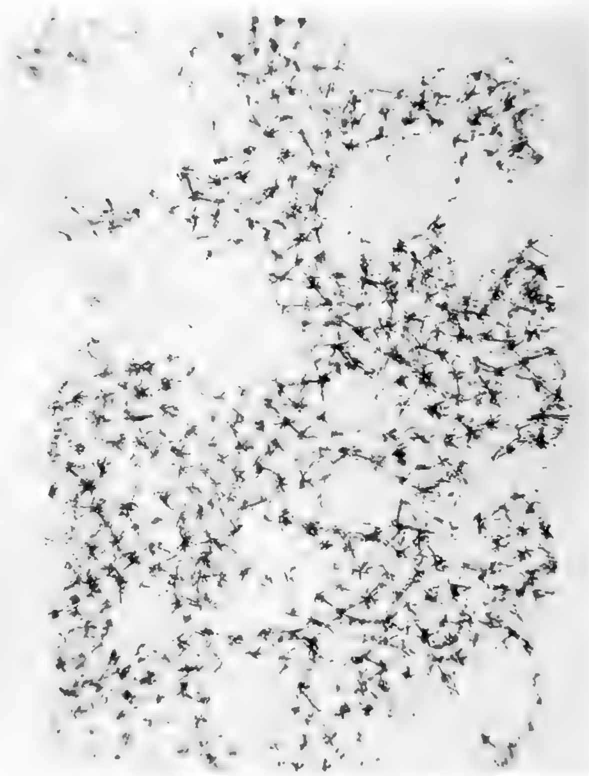

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PLATE 25.

Plate 25.

Microphotographs of thick unstained preparations showing skeletal arrangement.

Fig. 1. *Phakellia lamelligera.* Section vertical to surface, and passing completely through lamellate wall; in horizontal plane of sponge; x 15.

" 2. *Auletta dendrophora.* From a median longitudinal section through a "person." Left margin of figure represents surface of sponge; right margin, surface of paragastric cavity. Along latter margin appears a longitudinal skeletal fibre, from which short echinating spicules project; x 30.

" 3. *Phakellia lamelligera.* Skeletal lamella, seen from its flattened face. Long projecting spicules along right and left margins of figure are the spicules projecting from surfaces of sponge. Lamella was dissected out and cleaned with potash; x 10.

" 4. " " Idem. Figure was not well reproduced, and the projecting (prostal) spicules are indistinct; x 10.

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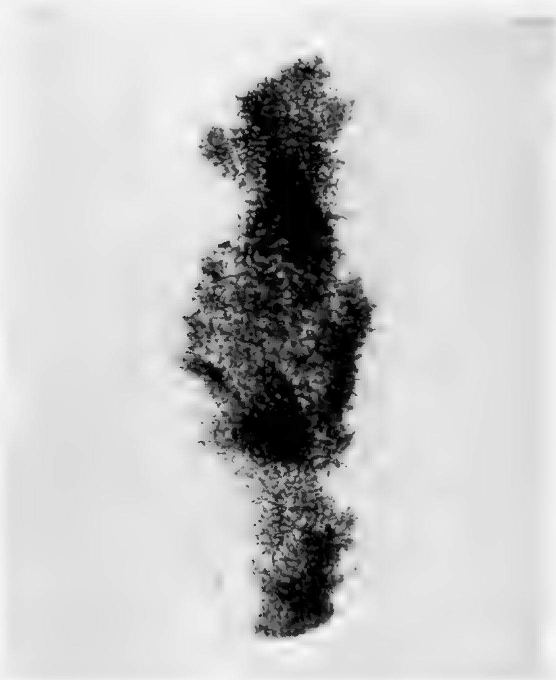

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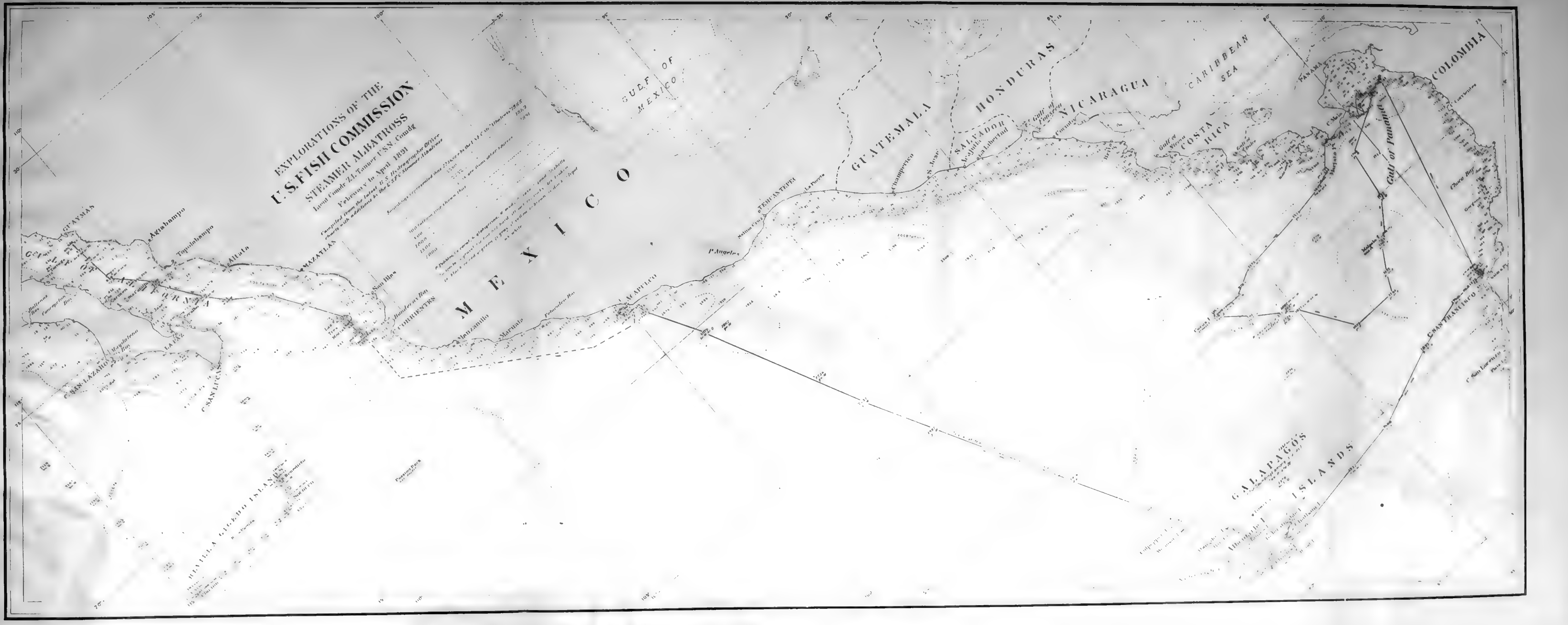
HONDURAS
SALVADOR
Acajutla
La Libertad
Gulf of Fonseca
Corinto
GUAYMAS
Tortuga
Ballenas Bay
Concepcion Bay
C. SAN LAZAR
Track of the U.S.F.C. Str. 'Albatross 1891
110°
115°
30°
25°
20°
85°
15


EXPLORATIONS OF THE
U.S. FISH COMMISSION
STEAMER ALBATROSS
Lieut Comdr Z.L. Tanner U.S.N. Comdg
February to April 1891
Compiled from the latest U.S. Hydrographic Office charts with additions by the U.S.F.C. Steamer Albatross
MEXICO
GULF OF MEXICO
GUATEMALA
HONDURAS
SALVADOR
NICARAGUA
COSTA RICA
CARIBBEAN SEA
COLOMBIA
PANAMA
Gulf of Panama
GALAPAGOS ISLANDS
GUAYMAS
Agiabampo
Topolobampo
Altata
MAZATLAN
San Blas
CORRIENTES
Manzanillo
ACAPULCO
P. Angeles
TEHUANTEPEC
C. SAN LAZARO
C. SAN LUCAS
Magdalena Bay
REVILLA GIGEDO ISLANDS
C. SAN FRANCISCO

The following Publications of the Museum contain Reports on the Dredging Operations in charge of Alexander Agassiz, of the U. S. Fish Commission Steamer "Albatross," during 1891, Lieut. Commander Z. L. Tanner, U. S. N., Commanding.

Three Letters from ALEXANDER AGASSIZ to the Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, on the Dredging Operations of the "Albatross" in 1891. Bull. M. C. Z., Vol. XXI. No. 4. June, 1891. 16 pp.

I. A. AGASSIZ. On Calamocrinus Diomedæ, a new Stalked Crinoid from the Galapagos. Mem. M. C. Z., Vol. XVII. No. 2. January, 1892. 95 pp. 32 Plates.

II. A. AGASSIZ. General Sketch of the Expedition of the "Albatross," from February to May, 1891. Bull. M. C. Z., Vol. XXIII. No. 1. February, 1892. 89 pp. 22 Plates.

III. A. GOËS. Neusina Agassizi. Bull. M. C. Z., Vol. XXIII. No. 5. December, 1892. 4 pp. 1 Plate.

IV. H. LUDWIG. Vorläufiger Bericht über die erbeuteten Holothurien. Zeit. Anz., No. 420. 1893. Bull. M. C. Z., Vol. XXIV. No. 4. June, 1893. 10 pp.

V. GEO. P. MERRILL. The Rocks of the Galapagos. Bull. M. C. Z., Vol. XVI. No. 13. July, 1893. 3 pp.

VI. W. FAXON. Preliminary Descriptions of new Species of Crustacea. Bull. M. C. Z., Vol. XXIV. No. 7. August, 1893. 72 pp.

VII. S. H. SCUDDER. The Orthoptera of the Galapagos. Bull. M. C. Z., Vol. XXV. No. 1. September, 1893. 25 pp. 3 Plates.

VIII. W. SCHIMKÉWITSCH. The Pygnogonidæ. Bull. M. C. Z., Vol. XXV. No. 2. December, 1893. 17 pp. 2 Plates.

IX. W. McM. WOODWORTH. The Planarians. Bull. M. C. Z., Vol. XXV. No. 4. January, 1894. 4 pp. 1 Plate.

X. TH. STUDER. Note préliminaire sur les Alcyonaires. Bull. M. C. Z., Vol. XXV. No. 5. February, 1894. 17 pp.

XI. S. F. CLARKE. The Hydroids. Bull. M. C. Z., Vol. XXV. No. 6. February, 1894. 7 pp. 5 Plates.

XII. H. LUDWIG. The Holothurians. Mem. M. C. Z., Vol. XVII. No. 3. October 1894. 183 pp. 19 Plates.

XIII. R. BERGH. Die Opisthobranchien. Bull. M. C. Z., Vol. XXV. No. 10. October, 1894. 109 pp. 12 Plates.

XIV. A. ORTMANN. The Pelagic Schizopoda. Bull. M. C. Z., Vol. XXV. No. 8. September, 1894. 13 pp. 1 Plate.

XV. W. FAXON. The Crustacea. Mem. M. C. Z., Vol. XVIII. April, 1895. 292 pp. 67 Plates.

XVI. W. GIESBRECHT. Die Pelagischen Copepoden. Bull. M. C. Z., Vol. XXV. No. 12. April, 1895. 20 pp. 4 Plates.

XVII. C. H. TOWNSEND. The Birds of Cocos Island. Bull. M. C. Z., Vol. XXVII. No. 3. July, 1895. 8 pp. 2 Plates.

XVIII. C. HARTLAUB. Die Comatuliden. Bull. M. C. Z., Vol. XXVII. No. 4. August, 1895. 26 pp. 4 Plates.

XIX. G. W. MÜLLER. Die Ostracoden. Bull. M. C. Z., Vol. XXVII. No. 5. October, 1895. 10 pp. 3 Plates.

XX. A. GOËS. The Foraminifera. Bull. M. C. Z., Vol. XXIX. No. 1. February, 1896. 103 pp. 9 Plates.

XXI. O. MAAS. Die Medusen. Mem. M. C. Z., Vol. XXIII. No. 1. September, 1897. 92 pp. 15 Plates.

XXII. H. J. HANSEN. The Isopoda. Bull. M. C. Z., Vol XXXI. No. 5. December, 1897. 38 pp. 6 Plates.

XXIII. A. AGASSIZ. Preliminary Report on the Echini. Bull. M. C. Z., Vol. XXXII No. 5. June, 1898. 18 pp. 14 Plates.

XXIV. E. L. MARK. Preliminary Report on Branchiocerianthus urceolus. Bull. M. C. Z., Vol. XXXII. No. 8. August, 1898. 8 pp. 3 Plates.

XXV. C. F. LÜTKEN and TH. MORTENSEN. The Ophiuridæ. Mem. M. C. Z., Vol. XXIII. No. 2. November, 1899. 114 pp. 22 Plates and Chart.

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